Vol. 32 January, 1939 No. 3

QUARTERLY

OF THE

National Fire Protection Association

Subscriptions to the QUARTERLY are accepted only as a part of the general publications of the Association which are sent to members. Associate membership is open to anyone interested; annual dues $10.

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60 BATTERYMARCH STREET, BOSTON, MASS.

Application Blank for Associate Membership

Associate Membership is open to any Society, Firm, Corporation or Individual interested in the protection of life and property against loss by fire. Persons in every walk of life are members.

National Fire Protection Association

INTERNATIONAL

Organized 1896

EXECUTIVE OFFICE: 60 BATTERYMARCH STREET, BOSTON, MASSACHUSETTS

All the valuable engineering and popular literature issued by the Association is sent, as issued, to every member.

We furnish free to members the Regulations issued by the National Board of Fire Underwriters, and the lists of devices and materials inspected by Underwriters' Laboratories, Inc.

The Association is the clearing house for all the authoritative information on Fire Protection and Prevention and members are privileged to submit to it their individual problems for solution.

PUBLICATIONS

Quarterly Magazine of the Association. A chronicle of the Association's activities, with valuable contributions of articles on fire prevention and protection and special hazards, and compilations of fire statistics on various classes of property.

News Letter. A special monthly bulletin of timely information on fire prevention and kindred subjects.

Proceedings of Annual Meeting. Containing stenographic report of transactions of the Association and the discussions incident to the adoption of its standards.

Special reports, bulletins, etc., issued frequently during the year.

Year-book and directory. Complete list of members with addresses.

Index to all subjects covered in the Printed Records.

NATIONAL FIRE PROTECTION ASSOCIATION,
60 Batterymarch Street, Boston, Mass.

Please enroll me (or us) as an associate member, and forward the publications to which members elected this month are entitled. I transmit herewith $10.00 as my annual membership dues, which includes a year's subscription to the "Quarterly" of the National Fire Protection Association.

Name.....

Business Connection.....

Street and Number.....

City and State.....

Membership year begins with date of election.

$10 per year dues is the total expense.

No initiation fee, no further assessments.

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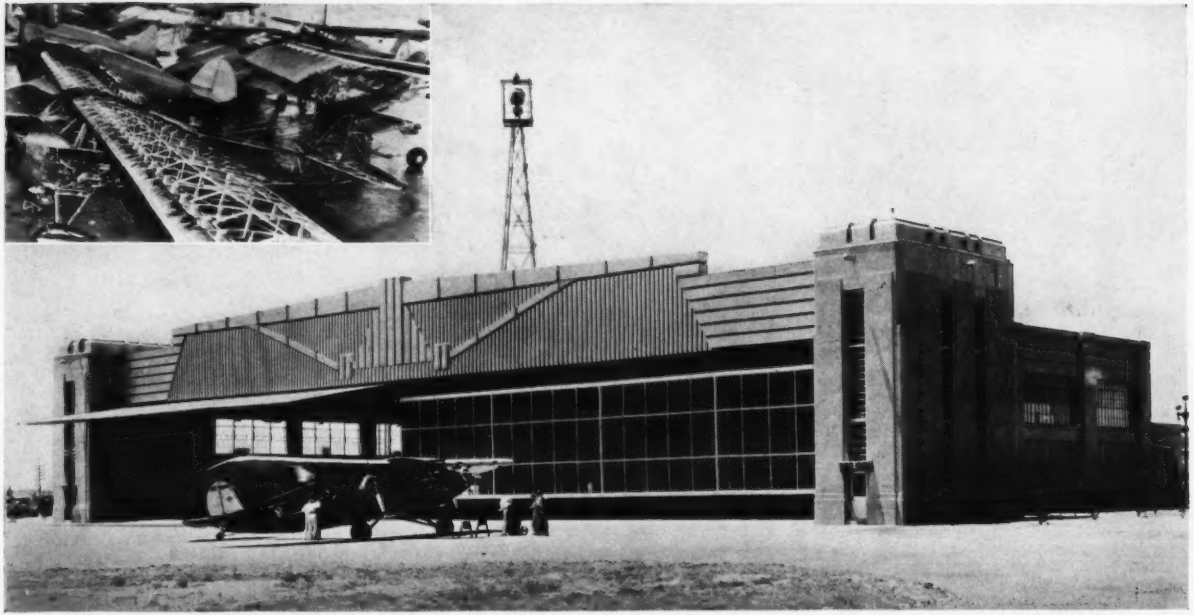

This modern hangar at the Shushan Airport, New Orleans, is equipped with a deluge type sprinkler system with rate-of-rise thermostatic control. The value of this protection was conclusively shown the evening of Nov. 11, 1938, when fire started on the freshly doped wing fabric of one of 32 planes closely nested in the closed hangar. The sprinkler system controlled the fire with only $1700 damage, with fire limited to one plane and overlapping parts of 2 others, as shown in inset. (Report by H. P. Dixey, Louisiana Rating and Fire Prevention Bureau, Member N.F.P.A.)

The Quarterly

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Do It Yourself. Every N.F.P.A. member whose work or amusements take him about and who keeps his eyes open sees fire hazards every day, obvious conditions that should be corrected in the interest of fire safety. Accumulations of rubbish, obstructed exits, inoperative fire equipment and similar obvious conditions may be seen by any intelligent observer in any city or town every day. How many of us do anything about it? Except where it is our business to make an inspection, we seldom even mention such hazards.

If every N.F.P.A. member were to take some appropriate action every time he saw a hazardous condition in a store, factory, office building, theatre, school or a friend's home, this would have a major effect in reducing losses of life and property by fire. Most people, however, are reluctant to call attention even to the most glaring hazard, feeling that it is none of their business and that they would get no thanks for gratuitous fire prevention advice. Americans are prone to leave complete police responsibility to the regularly constituted police authorities and do nothing whatsoever themselves, save in major crimes of violence.

The ordinary citizen does not wish to be considered a snooper — and the N.F.P.A. member does not have to be in order to spread the gospel of fire prevention among all those with whom he comes in daily contact. A friendly word is often all that is needed. When you hear that your friend's wife has bought gasoline for home dry cleaning you can wish her good luck, remarking that 200 people were killed last year in home dry cleaning explosions. When you see wooden barrels and cardboard cartons used for ashes and rubbish you can remark that you have found metal containers neater, cheaper in the long run, and incidentally safer from fire. A few friendly words like this every day in your casual contacts may have a tremendous cumulative effect in the course of the year.

There are occasional cases where a friendly word is not sufficient, and where it is a duty to report to the appropriate authorities. Explosives stored in an apartment basement, main exit doors locked during a large public meeting, nitrocellulose motion picture film shown in a school with no booth, and similar situations where the lives of the public are seriously endangered

should be reported to the fire chief or fire marshal. The reporting member does not have to appear publicly in such cases. All he needs to do is to suggest to the chief or fire marshal that an inspection be made.

* * * * *

Wages, Hours and Watchmen

The watchman is a traditionally important element in fire protection. For years we have relied upon watchmen making their rounds while business houses and factories are closed at night and on Sundays and holidays to detect and correct conditions that might cause fire, and if fire starts to summon aid, use fire extinguishers, start fire pumps, or take such other action as may be necessary. While the careless or unintelligent watchmen may sometimes be worse than useless, the tendency in recent years has been for employers to recognize that the position of watchman is one of trust and responsibility and to employ competent men for such work, gradually abandoning the former common practice of employing physically or mentally deficient men who can no longer be used for regular work.

With the adoption of the Wage and Hour law, this entire situation in the United States may be changed. The law provides the minimum pay at the rate of 25 cents an hour, with a maximum work week of 44 hours, and payment of 1½ times the regular rate for all work in excess of 44 hours per week. The law further provides in future years for the gradual increase of the minimum rate to 40 cents and decrease in the number of hours to 40. Watchmen are customarily employed for long hours at relatively modest pay. The work is not ordinarily arduous and conditions of employment have been such that there have been usually plenty of competent men anxious to serve as watchmen who were apparently satisfied with the hours of employment and rates of pay regularly offered.

The Wages and Hours legislation will, according to views of some employers, make it economically difficult to continue watchman service under the conditions that have formerly obtained. In many plants compliance with the law would mean practically doubling the number of watchmen in order to secure the same protection. The alternative of employing men physically or mentally handicapped for this particular service, thus securing an exemption from the application of the minimum wage requirement, would be unfortunate as regards fire protection.

There are several possible ways in which employers may meet this situation. First and most desirable from the fire protection point of view, though often economically impracticable, is to employ sufficient additional men so that the same watch service can be maintained and no man will be called upon to work more than 44 hours a week. Another plan is to reduce the working hours of the watchmen, not having them continuously on duty, but confining their service to such periods as present the greatest hazard. Fire experience

shows that the largest number of fires start within a few hours after closing time. This suggests that perhaps the greater part of the benefit of watchman service could be obtained by having men go on duty when the plant closes at 4 or 5 in the afternoon and continue until 10 or 11 in the evening, leaving the plant without watch service for the balance of the night. Another alternative is the greater use of automatic fire alarm and sprinkler supervisory equipment. With such automatic means for detecting fire to supplement a reduced watch service, satisfactory protection might be maintained.

* * * * *

Hazardous Locations. It is an axiom of fire protection that no open flame or spark producing device should be permitted in a place where readily flammable or explosive vapors, dusts, or other hazardous materials are present. This principle is universally accepted, but its practical application often involves troublesome problems.

There are many cases where the application of the principle is obvious. Any room which normally contains a mixture of vapor or dust with air in explosive proportions should obviously contain no process or equipment that might cause ignition. There are, however, many places where the atmosphere is normally safe and the hazardous material is confined within tanks, pipes or enclosed equipment of some kind. In such cases the danger occurs only when there is some failure which permits the escape of the hazardous vapor or other material, and at the same time there is some spark. Where the principal occupancy of a room is gasoline pumps, pipe and tanks it seems clear that the room should be considered a hazardous location, owing to the possibilities of leaks, even though in normal operation the atmosphere is non-explosive. On the other hand, any ordinary gas pipe may conceivably fail and produce an explosive mixture in the room, but no one would think of prohibiting all open flame or spark producing devices merely because of the presence of a gas pipe. Somewhere between these two extremes the line must be drawn. It is often difficult to make decisions in border-line cases and practically impossible to draw any hard and fast rules which can be universally followed. Many factors affect the hazard. The question of the character and amount of the hazardous material, the character of the equipment in which it is contained or used, the size of the room and its ventilation in relation to the possible liberation of hazardous material are all factors to be considered. Likewise potential sources of ignition must be analyzed. Equipment which produces flame or sparks in normal operation is in a different class from that which does not usually produce sparks, but which may do so if there is some failure.

Another phase of this problem is the determination of the limiting distance from some point of liberation of vapors or other flammable materials that should be considered hazardous. A dip tank where flammable solvents are used is generally considered a hazardous location. How far does the

hazard extend from the tank? A small tank at one end of a large manufacturing building does not make the whole building a hazardous location. On the other hand in some cases the nature of the process and arrangement of the building may be such that flammable vapors may be carried long distances from their point of origin.

Electrical installations bring the problem up most frequently. In the absence of any rules to fix the exact limits of a hazardous location it is often a nice problem to determine to what extent explosion-proof electrical equipment should be required. This is a difficult problem for many electrical inspectors whose experience has been largely limited to electrical matters and who are not familiar with special hazards. There is no simple answer, but the problem should be solved in any individual case through the application of good fire protection engineering judgment, with coöperation between electrical inspectors and those concerned with special hazard matters.

The 1938 Fire Loss.

The preliminary estimate of the fire loss in the United States for the year 1938 is $303,291,056. This amount is based on estimates compiled by the National Board of Fire Underwriters for the first eleven months of the year, with a figure for December based upon loss experience for the same month in previous years. This total estimate is nearly $19,000,000 more than the 1937 preliminary loss estimate, and shows the result of the upward swing in losses begun in July.

Comparative Monthly Loss Estimates, 1936, 1937, 1938.

	1936	1937	1938
January	$27,729,930	$25,069,895	$27,673,337
February	30,909,896	28,654,962	26,472,626
March	29,177,406	29,319,029	29,050,968
April	25,786,835	26,663,854	25,616,112
May	21,479,380	21,437,739	22,917,577
June	20,407,485	19,524,765	19,473,617
July	22,357,020	19,812,485	20,434,688
August	21,714,495	19,767,314	20,821,184
September	20,413,537	19,349,756	23,372,528
October	20,439,136	21,097,670	24,797,624
November	20,808,497	23,849,673	28,658,695
Total 11 months	$263,223,617	$254,547,142	$269,291,056
December	30,133,628	30,172,952	34,000,000*
Total 12 months	$293,357,245	$284,720,094	$303,291,056
Adjusted loss figures (Released later in year.)	$266,659,449	$253,859,796	

*December figure is estimated on the basis of previous years.

NOTE. It may be noted that the final loss figures for both 1936 and 1937 are less than the preliminary loss figures for those years. It may be assumed, therefore, that the adjusted loss figure for 1938 will also be lower than the preliminary estimate.

Aggregate Loss for 23 Years is Over Nine Billion Dollars.

The 1938 fire loss brings the total fire waste in the United States during the past twenty-three years up to $9,236,221,293, which is an annual average about $400,000,000. The following table gives the annual fire losses by years since 1916.

1916	$258,377,952	1928	$464,607,102
1917	289,535,050	1929	459,445,778
1918	353,878,876	1930	501,980,624
1919	320,540,399	1931	451,643,866
1920	447,886,677	1932	406,885,959
1921	495,406,012	1933	271,453,189
1922	506,541,001	1934	271,197,296
1923	535,372,782	1935	235,263,401
1924	549,062,124	1936	266,659,449
1925	559,418,184	1937	253,859,796
1926	561,980,751	1938 (Est.)	303,291,056
1927	472,933,969		

Large Loss Fires, 1938.

During the year 1938 there were reported to the N.F.P.A. Department of Fire Record thirty-six fires in the United States, involving a loss estimated at $250,000 or more each. This is an increase of thirteen fires over 1937, but is only three fires above the average number of such fires for the past five years. During 1938 there were six fires in this classification in Canada, which compares with two fires in 1937. The locations of these forty-two large loss fires are shown on the accompanying annual conflagration map.

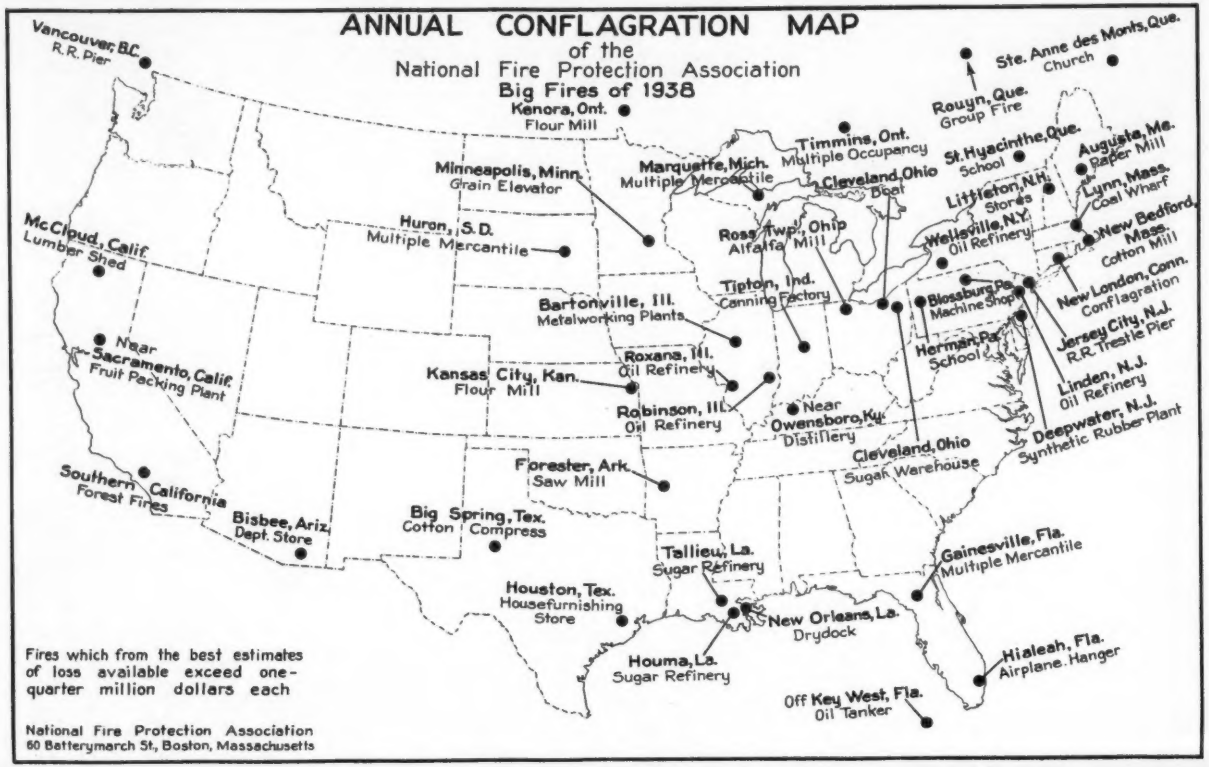
Seventeen fires caused losses of $500,000 or more, including five which were of $1,000,000 or more. The largest loss of the year, aside from the $3,000,000 loss in the series of forest fires in southern California, during the week of November 23, was the whiskey distillery fire in Owensboro, Ky., on November 12, with a loss of $1,800,000.

A total of sixty-one lives were lost in six of these forty-one big fires of the year. Forty-six of these lives were lost in the school fire in St. Hyacinthe, Que., on January 18.

The following table shows the occupancies which were involved in more than one of the large loss fires.

Group fires	6	Boats	2
Oil refineries	4	Department stores	2
Piers and wharves	4	Lumber plants	2
Sugar houses or refineries	3	Metal working plants	2
Flour mills, grain elevator	3	Schools	2

A summary of each of the forty-two fires is presented below to show the factors responsible for each large loss as far as the information is available. The loss figures in most instances are adjusted figures or authoritative estimates.


ANNUAL CONFLAGRATION MAP
of the
National Fire Protection Association
Big Fires of 1938
Vancouver, B.C.
R.R. Pier
Kenora, Ont.
Flour Mill
Minneapolis, Minn.
Grain Elevator
Huron, S.D.
Multiple Mercantile
Marquette, Mich.
Multiple Mercantile
Timmins, Ont.
Multiple Occupancy
Cleveland, Ohio
Boat
Ste. Anne des Monts, Que.
Church
Rouyn, Que.
Group Fire
St. Hyacinthe, Que.
School
Auguste, Me.
Paper Mill
Littleton, N.H.
Stores
Lynn, Mass.
Coal Wharf
Wellsville, N.Y.
Oil Refinery
New Bedford, Mass.
Cotton Mill
Mc Cloud, Calif.
Lumber Shed
Ross Twp., Ohio
Alfalfa Mill
Tipton, Ind.
Canning Factory
Blossburg, Pa.
Machine Shop
New London, Conn.
Conflagration
Bartonville, Ill.
Metalworking Plants
Herman, Pa.
School
Jersey City, N.J.
R.R. Trestle Pier
Near
Sacramento, Calif.
Fruit Packing Plant
Roxana, Ill.
Oil Refinery
Kansas City, Kan.
Flour Mill
Robinson, Ill.
Oil Refinery
Linden, N.J.
Oil Refinery
Near
Owensboro, Ky.
Distillery
Deepwater, N.J.
Synthetic Rubber Plant
Cleveland, Ohio
Sugar Warehouse
Forester, Ark.
Saw Mill
Southern California
Forest Fires
Bisbee, Ariz.
Dept. Store
Big Spring, Tex.
Cotton Compress
Tallieu, La.
Sugar Refinery
Gainesville, Fla.
Multiple Mercantile
Houston, Tex.
Housefurnishing
Store
New Orleans, La.
Drydock
Houma, La.
Sugar Refinery
Hialeah, Fla.
Airplane Hanger
Off Key West, Fla.
Oil Tanker
Fires which from the best estimates of loss available exceed one-quarter million dollars each
National Fire Protection Association
60 Batterymarch St., Boston, Massachusetts

January 18, St. Hyacinthe, Que., Sacred Heart College. Loss: $280,000 and 46 Lives.

Fire which followed a coal gas explosion almost instantly enveloped an old, 4-story, brick-joisted school building. Forty-one boys and five brothers out of the 96 boys, 26 brothers, and five employees asleep in the building at the time lost their lives. The heating consisted of five hot air furnaces, which were not installed with modern safeguards. Evidence of an explosion appeared in an old unused chimney in the openings at the upper floors. Apparently flames spread from these openings and communicated to the combustible interior construction. Open stairs, lack of interior cut-offs, and inadequate fire escapes permitted the flames to spread rapidly and trap the victims. (April, 1938, QUARTERLY, page 275.)

January 23, Deepwater, N. J., DuPont Neoprene Plant. Loss: $350,000 and 3 Lives.

A series of explosions in this synthetic rubber plant damaged several buildings and killed three employees. The three men were attempting to relieve the abnormal pressure which had developd in a divinylacetylene tank when the tank exploded. Eight other explosions followed. With each explosion, a brilliant column of flame nearly 400 feet high flashed into the sky. Flying débris fell in sections of the plant as far as 700 feet away from the fractionating building. The sprinkler system in the building was completely wrecked before fire ensued, and due to the highly flammable contents, little attempt was made to extinguish the fire in the buildings involved.

January 25, Marquette, Mich., Multiple Mercantile. Loss: $255,000.

Fire starting in one of three brick and stone joisted business buildings during a snowstorm and high winds was not discovered until it came through the roof. Firemen were driven out of the building shortly after they arrived by the extent of the fire, intense heat, smoke, and falling débris. Snowdrifts handicapped them at the rear of the building and prevented outside aid being sent from neighboring cities. Floor openings were unprotected. Fire doors between this building and the two adjoining ones were effective, but apparently the fire spread from roof to roof and through the walls, which buckled from the intense heat. All three buildings were destroyed and with the exception of records in safes, very little of the contents of the 13 mercantile and office occupancies was salvaged.

January 30, Tipton, Ind., Stokely Bros. Cannery. Loss: $299,000.

There was a delay of about 15 minutes after a boy noticed a fire in this canning factory before the fire department was notified. Two pumpers responded, but one was wrecked as it left the station by hitting an automobile and never reached the fire. The frame construction of the plant and high wind caused the fire to spread rapidly. A lack of sufficient engine streams handicapped the firemen in checking the spread. Water supplies and the number of hydrants were deficient. All of the communicating frame buildings and the boiler house were destroyed.

February 10, Lynn, Mass., Lynn Gas and Electric Co. Loss: $500,000.

Fire started under the wooden deck of a coal unloading wharf. The creosoted planking and timbers of which this 650 ft. wharf was constructed and the accumulation of coal dust on them produced a hot fire which quickly got out of control. There were no subdividing bulkheads or other fire stops, no equipment for under-pier fire fighting, and no provisions to make this space accessible. Attempts to use hose streams and cellar nozzles were ineffective, and the fire seriously damaged the wharf, destroyed two coal unloading towers, and destroyed or damaged several enclosed belt conveyors. (April, 1938, QUARTERLY, page 319.)

February 22, Timmins, Ont., Multiple Occupancy. Loss: $250,000.

Fire started in the basement of a two-story frame building occupied on the first floor as a clothing store and having apartments and offices above. The fire department confined the fire to the building, but there was considerable smoke and water damage to adjoining properties.

March 16, Herman, Pa., St. Fidelis Seminary. Loss: $250,000.

Fire started on the first floor carpenter shop of a large 3-story brick-joisted school building and annex. Sixty-five students asleep in the third floor dormitory managed to escape only a few minutes before the fire cut off all means of escape. Large amounts of combustible

The $250,000 fire at Herman, Pa., which destroyed a Catholic seminary on March 16, 1938. Combustible interior construction, unprotected openings, and insufficient water were contributing factors.

interior construction and contents, and unprotected vertical and horizontal openings permitted the fire to spread rapidly. In addition to the two buildings, a valuable library and all records of the institution were destroyed. The community fire company manned by lay brothers, priests and students concentrated their efforts on saving the monastery and a new wing. They were hampered by a shortage of water.

March 20, Cleveland, Ohio, Steamer "City of Buffalo." Loss: $400,000.

This side-wheel passenger steamer of 2940 gross tons, built in 1896, had a steel hull and carried cargo on the main deck. The main deck and the two passenger decks above were of wooden construction. The ship was laid up at the dock for the winter and was undergoing repairs. Temporary electric circuits for lighting purposes were connected to the shore supply. While the watchman was making his rounds he discovered the fire, which apparently started in the dining room below the main deck aft. He turned in the alarm and the fire department responded promptly, but the fire had gained considerable headway when they arrived. Although the ship was completely equipped with automatic sprinklers, they were of no value because the system was shut off. There was no steam to operate the steam fire pump, and the ship was not equipped with an auxiliary automatically operated electric fire pump as had been recommended by the company that installed the sprinkler equipment. (April, 1938, QUARTERLY, page 272.)

March 22, Houston, Texas, Waddell's Housefurnishing Co. Loss: $400,000.

This 6-story brick-joisted building was quickly destroyed by fire because of large combustible stock of furniture and draperies, the excessive floor areas with no cut-offs, three open elevators, and one open stairway piercing all floors. Flames appeared suddenly on all floors about the time the fire department arrived, thus preventing access to the building. Lack of exposure protection was responsible for serious losses to several adjoining properties.

March 25, Tallieu, La., Supreme Sugar House. Loss: $523,000.

Fire destroyed a large metal-clad frame sugar refinery of approximately 71,000 sq. ft. of floor space in one area without cut-offs, including the boiler house. About 125 employees were at work at the time, but their attempts at fire fighting with 1½-inch hose lines from standpipes were not effective. The fire spread so rapidly that they were forced to leave. The combustible construction, large undivided areas, accumulation of flammable dust and flyings, and a strong wind contributed to the rapid spread. There was no outside protection, and by the time fire fighting equipment arrived from the nearest town, 15 miles away, the entire structure was involved. The loss includes 10 freight cars containing sacked sugar.

April 2, Hialeah, Fla., Miami Municipal Hangar. Loss: $360,000.

Fire starting in an airplane quickly spread to about nine other airplanes in a modern hangar having a concrete floor, concrete block walls, and wood-sheathed roof on unprotected steel trusses. Intense heat and large volumes of smoke and gases from burning gasoline and fabrics handicapped firemen. Lack of automatic sprinkler protection and an insufficient water supply were the chief factors responsible for the rapid and complete destruction. (July, 1938, QUARTERLY, page 43.)

April 7, Huron, S. D., Multiple Mercantile. Loss: $250,000.

An early morning fire in a dry goods store involved the whole building before the fire department was notified and arrived on the scene. The fire spread rapidly along the roofs of adjoining buildings. After a 6-hour battle the fire was brought under control, but not until it had gutted five store buildings and destroyed valuable records of two ex-service men's organizations, the Chamber of Commerce and the Boy Scouts' office. Stocks not burned were seriously damaged by water and smoke.

April 14, Ross Twp., near Toledo, Ohio, Saunders Mills, Inc. Loss: $250,000.

Fire was discovered by the watchman on the top floor of this 3-story alfalfa mill. The water supply was from an electrically driven deep well pump which supplied a 1000-gallon underground pressure tank. The watchman tried to extinguish the fire with hose attached to a standpipe, but the water supply failed. A second fire near the main electric switch disrupted the electric service. After some delay, the township fire department was called, but the building was entirely in flames when they arrived. After electric service was restored only a small amount of water was available and fire spread to the near-by leaf mill and feed warehouse buildings. All three buildings were of wood frame ironclad construction, and were completely destroyed. In addition to inadequate water supply, the highly combustible contents, accumulations of dust, and a combustible conveyor between two of the buildings were factors contributing to the large loss.

April 17, Ste. Anne des Monts, Que., Church. Loss: $250,000.

Fire started in the vaulted ceiling of this stone church built in 1924. The fire occurred during Mass and the people carried out all movable contents. There were no fire protection facilities, and it was impossible to reach the fire with pails of water. In a short time nothing remained but the walls.

April 21, Minneapolis, Minn., Pillsbury Elevator. Loss: $419,000.

Fire consumed this 55-year old terminal grain elevator and its 120 ft. high annex. Both buildings were of frame cribbed construction with ironclad sides. The watchman discovered the fire on the upper floor shortly after 1 a.m. He and firemen attempted to use the standpipe and hose, but found that the water had not yet been turned on after having been shut off for the winter. No attempt was made to use the water barrels and pails with which the elevator was equipped. The fire made such headway that within an hour it had spread throughout the elevator and through conveyor openings to the annex. An inadequate water supply and the lack of automatic sprinkler protection were additional factors contributing to the large loss. About 75 per cent of the loss was to grain.

April 25, Gainesville, Fla., Multiple Mercantile. Loss: $300,000.

Fire started just after midnight in the paint and oil section of a 2-story brick-joisted hardware store. Apparently it had been smouldering for some time before it was discovered,

and when the fire department arrived the fire had vented itself through windows and doors. With the ignition of the flammable vapors or gases in the building, the fire spread with unusual rapidity. The building was long and narrow and closely surrounded by other buildings, making the fire difficult to reach. Unprotected floor openings in this building, and unprotected wall openings in all the buildings (all brick-joisted) were largely responsible for the spread of the fire to the entire block. Five buildings were destroyed and the other seven were damaged. Stock in all the various retail stores and offices was damaged. The fire department, consisting of only 12 paid men, was handicapped by the lack of trained man power.

May 4, Roxana, Ill., Shell Petroleum Corp., Refinery. Loss: $400,000.

Fire started in the brick and steel compounding house due to hot lubricating oil spraying on a steam pipe. Employees were delayed in getting the refinery foam apparatus in operation by a defective pump suction valve. A number of hose streams were quickly placed in operation, causing hydrant pressure to fail and the fire soon involved the entire building, although pumpers from surrounding towns later supplied effective pressures. A high wind assisted the spread of the fire. The loss was about equally divided between building and contents.

May 28, near Sacramento, Calif., Bercut-Richards Packing Co. Loss: $550,000.

Fire in a large 1-story tile warehouse, containing millions of cans of fruits and vegetables, had a head start before it was discovered. The flames spread rapidly and destroyed most of the contents. Firemen confined the fire to the one warehouse.

July 17, Wellsville, N. Y., Sinclair Refinery. Loss: $1,000,000 and 3 Lives.

Fire started in the centrifuge building of the oil refinery. A steam valve was operated promptly, but failed to control the fire. The intense heat ruptured pipe lines and released flaming oil, spreading the fire to various process tanks and buildings. During a fire in this oil refinery, a 2000-barrel tank, containing naphtha and oil, exploded and fell in an open field nearly 600 ft. away and burned or crushed to death three spectators. The plant fire brigade, aided by various volunteer fire departments and the use of foam in very large quantity, extinguished the fire after 50 hours' work. (October, 1938, QUARTERLY, page 143.)

July 27, Vancouver, B. C., Canadian Pacific Ry. Pier. Loss: $780,000.

Starting at the water end of a 900 ft. frame constructed pier on creosoted piling, fire destroyed within a short time the entire pier and also a freight shed and part of the elevated roadway at the land end. Lack of automatic sprinklers under the deck and combustible construction permitted the fire to spread rapidly. There were no fire walls in the substructure or superstructure. The superstructure was sprinklered, but shortly after the arrival of the fire department, the fire was beyond control, and so many sprinkler heads operated that the water supply was overtaxed and the fire proceeded unchecked. Openings in the deck were not adequate for effective use by the fire department. There was no fireboat protection promptly available. (October, 1938, QUARTERLY, page 135.)

August 27, Kansas City, Kan., Ismert-Hincke Mill. Loss: $300,000.

Fire started in the sack room of a warehouse in the center of a group of flour mill buildings. The sack room was in a 3-story section of this 6-story brick-joisted warehouse. The fire spread rapidly to a conveyor belt, which carried it to other areas. When the first firemen arrived one entire end of the 3-story section was aflame and fire had already spread to the four top floors of the 6-story section. There were several unprotected openings between the two sections. Falling walls and explosions of chlorine gas used in bleaching flour handicapped firemen. Some time was lost at the start when hose was laid from a hydrant two blocks away. It is reported that employees fought the fire for some time with hand equipment before turning in an alarm. The fire had to be largely fought from the outside.

September 8, Jersey City, N. J., Pennsylvania Ry. Trestle-Pier. Loss: $250,000.

This property consisted of a wooden coal dock or pier which supported coal pockets and trestle above. It is reported that it had recently been coated with creosote. Fire started

Ruins of the 3 and 6-story warehouse of a large flour milling plant at Kansas City, Kan., on August 27, 1938 — the result of fire getting out of control of employees and firemen.

on the land trestle approach about 2 A.M. and spread rapidly to the coal dock. The intense heat and dense clouds of black smoke hampered fire fighting from land and tugboats. The trestle supports gave way and the nine railroad cars above, eight of which were filled with bituminous coal, fell into the bay. A brisk wind contributed to the spread of the fire.

September 20, Cleveland, Ohio, National Terminals Corp. Loss: $375,000.

Fire gained considerable headway in this dock terminal sugar warehouse before the fire department arrived, either because the employees failed to discover it for some time or because of its rapid spread. The building was of skeleton steel and iron-clad construction and contained over six million pounds of sugar in bags and boxes. Firemen were handicapped by the excessive heat until the flames broke through the roof. The steel framing buckled and the sugar melted and caught fire. Private fire protection was inadequate.

September 21, New London, Conn., Conflagration. Loss: $1,000,000.

At the height of the great New England hurricane, fire started in a warehouse at the waterfront. It was driven through a portion of the business district by a wind which reached 100 miles per hour. More than fifty buildings were destroyed or damaged. Flying brands started many fires in residential streets. The fire was fought under numerous handicaps; roads blocked by fallen trees prevented assistance being sent from other cities, telephone and fire alarm systems were out of service, light and power services were cut off, fire streams were broken into sprays by the wind and much of the fire area was inundated by the extremely high tide due to the hurricane. (October, 1938, QUARTERLY, page 123.)

September 22, Bisbee, Ariz., Phelps Dodge Department Store. Loss: $250,000.

Due to the lack of fire doors and fire stopping in the basement where the fire started about midnight, fire spread rapidly through the basement and communicated to the upper

floors by way of an open elevator shaft. The building was three stories high and of steel frame and brick construction. An explosion in the refrigerating section of the basement drove firemen from the area between the store and a warehouse from where they were fighting the fire. They then concentrated their efforts on saving adjoining property and the department store was destroyed.

September 26, Robinson, Ill., Ohio Oil Co., Refinery. Loss: $250,000 and 1 Life.

A leak in a gasoline pump in the treating plant resulted in an explosion which wrecked the building and killed an employee. The explosion liberated about 1000 barrels of naphtha. Burning naphtha and a strong breeze assisted the rapid spread of the flames to adjoining units and tanks. Sixteen tanks ranging in size from 500 to 2000 barrels, containing mostly gasoline, were either completely destroyed or seriously damaged. None of the tanks were equipped with flame arresters, or with vents of sizes such as recommended by the N.F.P.A. Flammable Liquids Ordinance. These tanks were in the older and congested part of the plant and were not diked. The damage to equipment alone was about $200,000.

September 28, New Bedford, Mass., Soule Mill. Loss: $800,000. (N.F.P.A. estimate.)

Fire in this cotton mill of slow-burning construction was promptly checked by sprinklers, but before it was completely extinguished the sprinkler valve apparently was shut. With the sprinklers shut off, the fire spread rapidly. (January, 1939, QUARTERLY, page 264.)

October 6, off Key West, Fla., Standard Oil Tanker. Loss: $575,000 and 3 Lives.

It is reported that an explosion in the dry cargo space forward of the cargo tanks caused the death of three men and the burning and sinking of the tanker *E. J. Bullock*. The vessel was 435 feet long, of 6630 gross tons, and was carrying about 75,000 barrels of crude oil. The hull was insured for $426,000.

October 12, Linden, N. J., Cities Service Oil Co., Refinery. Loss: $300,000.

The explosion of an all-steel gasoline storage tank liberated about 4600 barrels of burning gasoline into the congested tank area. Successive explosions quickly involved all of the 22 tanks in the 8-acre oil storage area. The tanks were not properly spaced or diked, and none were provided with proper vents. The water supply was inadequate until the arrival of two fireboats from New York City. The fire was finally extinguished by foam. (January, 1939, QUARTERLY, page 270.)

October 16, Forester, Ark., Caddo River Lumber Co. Loss: $250,000.

Starting on Sunday evening, fire apparently got a head start before it was discovered. The sawmill and the kiln house were destroyed and the power house was seriously damaged.

October 18, Big Spring, Texas, Big Spring Compress Co. Loss: $600,000.

Shortly after fire was discovered in two bales of cotton, flames raced over other bales in a large frame ironclad cotton warehouse which covered an entire city block. When the fire department arrived, the walls and roof were collapsing. The large area, unbroken by fire divisions, was largely responsible for the destruction of over 13,000 bales of cotton.

November 6, McCloud, Calif., McCloud River Lumber Co. Loss: $600,000.

Fire destroyed a large frame lumber shed and its contents of over 12,000,000 board feet of rough dry pine lumber, most of which was solidly piled. The sprinkler equipment slowed the burning, but failed to hold the fire in check because of the speed with which the fire opened a great number of heads, overtaxing the water supply mains. (January, 1939, QUARTERLY, page 257.)

November 12, Rouyn, Que., Group Fire. Loss: $290,000 and 7 Lives.

Fire started at the rear of the second floor of the 60-room Albert Hotel and spread so rapidly through the halls that seven of approximately 50 sleeping guests were trapped and burned to death, or died later from burns. Apparently the fire had been burning for some time before the fire department was notified. The adjoining Commercial Hotel, a grocery store, two clothing stores, a garage, and two dwellings were destroyed.

A $290,000 fire leveled these two hotels and six adjoining buildings, and burned to death seven persons in Rouyn, Que., on November 12, 1938.

November 12, near Owensboro, Ky., Glenmore Distillery. Loss: $1,800,000.

Starting in a large 2-story brick bottling house, fire had almost covered the entire floor shortly after the fire department arrived. When firemen attempted to enter by breaking open a door, an explosion occurred that blew out part of the wall. Explosions of large whiskey tanks caused the fire to spread to surrounding buildings, most of which were of frame ironclad construction. Reasons for the large loss were an inadequate water supply, lack of automatic sprinklers, construction and congestion of the buildings, inadequate vents on whiskey tanks, and inadequate drains to carry off burning whiskey. (January, 1939, QUARTERLY, page 252.)

November 19, Bartonville, Ill., Metal Working Plants. Loss: $295,000.

Fire starting in a washroom was discovered by the watchman at 2:38 A.M. The local fire department and the Peoria department responded promptly, but when they arrived the fire had already gained considerable headway. The building of origin (two stories high, brick-joisted construction) was destroyed. Firemen concentrated their efforts on protecting

adjoining buildings, but were handicapped by an inadequate water supply. One of these buildings, 15 ft. away, was sprinklered, but the fire destroyed a part of the roof, causing it to collapse and rupture two 3-inch sprinkler pipes. In spite of this, the sprinklers were effective in holding the loss in this building to about 50 per cent. A 3-story brick-joist building housing several other metal working plants, and a frame building were completely destroyed by exposure. The inadequate water supply was due in part to the rupture of a 5-inch riser in the building of origin which at one time supplied sprinklers there.

November 21, Kenora, Ont., Maple Leaf Milling Co., Ltd. Loss: $700,000.

Fire started between the top floor ceiling and the roof of a 7-story brick-joisted mill building. The sprinkler system operated, but the fire spread rapidly downward through elevator legs. Firemen were handicapped by the thick smoke and had some difficulty in getting heavy streams into the windows of the top floor. The collapse of the upper floors ruptured the water pipes and necessitated shutting off of the sprinklers in order to maintain sufficient pressure for hose lines. Conveyors carried the fire to a warehouse and to the grain elevator. All three structures were gutted.

November 23, Southern, Calif., Forest Fires. Loss: $3,000,000.

High winds and low humidity were largely responsible for a series of rapid-spreading forest and brush fires, which burned for several days in the Los Angeles-San Bernardino area. In two of the most serious fires over 65,000 acres burned and well over a hundred homes and camps were destroyed. The largest building loss resulted from the destruction of the large and fashionable Arrowhead Springs Hotel near San Bernardino, with a loss of $325,000. The National, State, County and municipal fire fighting forces were seriously handicapped by a lack of water supplies in the mountainous areas. (January, 1938, QUARTERLY, page 214.)

December 10, near Houma, La., Southdown Sugar Refinery. Loss: $920,000.

Four warehouses containing over 71,000 bags of sugar and the refinery section of this sugar plant were destroyed by fire. Due to unprotected openings in outside walls and the absence of standard fire walls, the fire spread unhindered. The combustible construction and crowded storage conditions also contributed to the large loss. The private fire protection was inadequate.

December 13, Blossburg, Pa., Ward Foundry Co. Loss: $480,000 and 1 Life.

An employee lost his life, and a large 1-story frame, metal-clad machine shop was rapidly destroyed by fire. The large loss was due to poor construction and protection, which allowed the fire to get out of control after chemical extinguishers had no effect.

December 15, Littleton, N. H., Multiple Mercantile. Loss: $300,000.

Three 3-story frame mercantile buildings without fire walls were quickly swept by fire which started in a hardware store. It was of incendiary origin. In addition to inadequate construction, heavy Christmas stocks in a dry goods store and department store were a factor in the large loss. A fourth frame building in the row was badly damaged. Zero temperatures handicapped firemen.

December 19, Augusta, Me., Kennebec Pulp and Paper Co. Loss: $560,000.

Fire destroyed the frame buildings housing the sulphite and wood sections of this paper plant. Sprinklers operated, but owing to structural conditions and sprinkler equipment of doubtful efficiency had not extinguished the fire before the weight of water-soaked paper products on the second floor caused the floor and walls to collapse and break sprinkler risers and feed pipes.

December 23, New Orleans, La., Todd-Johnson Dry Docks. Loss: $500,000.

Fire destroyed 650 feet of a wharf 1519 feet long and 31 feet wide, an all metal boiler house and the dock gear house. Two floating dry docks of wooden construction moored alongside the wharf were damaged. A diesel powered work boat, 55 feet long, burned and sank.

Factors Responsible for the Large Losses.

As in previous years, an analysis has been made of the forty-one fires to determine the factors that have been responsible for the large losses. In most

instances several factors contributed to the rapid spread of the fire and the extensive loss. The factors most frequently contributing to large losses were "inferior construction and excessive areas," and "highly combustible contents, excessive amounts of burnable stocks." The "lack of adequate private protection," such as automatic sprinkler systems, and the "lack of fire doors or cut-offs between sections" are two factors that are unusually prominent factors in the 1938 large loss fires.

These large losses might have been prevented or fires extinguished in their incipiency had adequate preparation been made beforehand. Several of the fires occurred at large plants just outside the limits of cities or small towns, and apparently the plant management in some instances gave but little consideration to the amount of public protection it might expect in case of fire, and did not provide adequate private protection. The accompanying table indicates the frequency of the most important factors responsible for the losses running to $250,000 or more each.

Reasons for Large Loss.	No. Times Contributing
Structural Factors	58
Inferior construction, excessive areas, etc.	29
Lack of sufficient exposure protection	16
Unprotected vertical openings	12
Wooden shingle roofs	1
Occupancy Factors	43
Highly combustible contents, excessive amounts of burnable stocks	27
Flammable liquids	10
Spread of flames enhanced by accumulations of dust	4
Unsafe heating equipment	2
Fire Protection	63
Lack of adequate private protection	23
Lack of fire doors or cut-offs between sections	18
Lack of adequate public protection	9
Sprinkler system of obsolete type or inadequate design	4
Sprinklers shut off	2
Standpipes shut off	1
Fire Fighting	28
Fire difficult of access for fire fighting	12
Poor fire fighting by employees	7
Fire department inadequately manned or equipped	3
Inexperience in fighting fires of such magnitude	3
Fire department delayed	3
Delays in Giving Alarm	14
Headway of fire when discovered	11
Effort made to extinguish fire without giving alarm	3
Water Supplies	13
Inadequate water supplies	11
Shortage of hydrants	2
Explosions	11
Strong wind	9
Oil tanks not in accordance with modern standards for spacing, vents, dikes	4
Outside aid impossible (hurricane, snowstorm)	2
Low humidity	1
Zero weather	1

Gasoline in Philadelphia Telephone Manhole.

By J. Sanderson Trump (Member N.F.P.A.),
Middle Department Rating Association, Philadelphia.

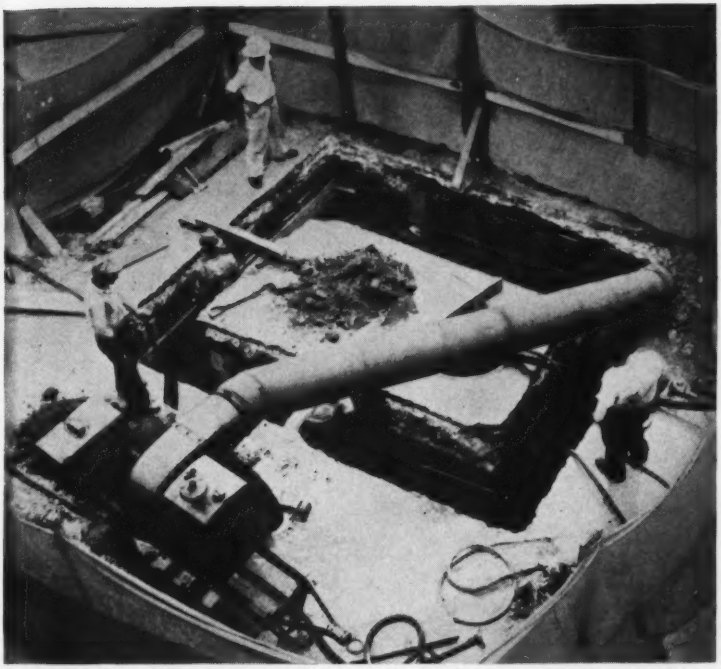
In January, 1938, it was discovered that gasoline was seeping into an underground telephone cable conduit at a manhole which is located near the Bell Telephone Company's exchange at 57th and Chestnut Streets, Philadelphia. An investigation was made by the telephone company and by the various oil companies owning tanks in the immediate vicinity, but all the sources of the seepage were not determined. Until October, when the manhole, which is sixteen feet in depth, was encased in concrete, it was necessary to pump out this seepage of gasoline every week or ten days.

During July I visited the scene of the trouble and found that the telephone company was using the utmost care in safeguarding its employees who worked in the manhole. A blower was used to force a draft into the manhole, but it was found that this procedure also forced the gasoline vapors through conduits into the basement of the exchange building. An attempt to seal the conduit at the point where it enters the basement failed to remedy the condition and the vapors continued to reach the upper floors.

In August, the telephone company excavated around the manhole preparatory to encasing it in concrete to prevent the inflow of liquids and vapors. The blower was used to provide fresh air for the men working in and around the manhole and to dissipate possible accumulations of gasoline vapors before they reached explosive proportions. The city had a pumper and four firemen on duty at all times, equipped with foam apparatus and a hose line already connected to a hydrant. Police were on duty to prevent smokers from approaching the excavation. Gasoline vapors in the manhole had become so concentrated that no one was permitted to enter it unless equipped with a gas mask.

The telephone company used a standard gasoline pump and gasoline hose to remove the mixture of gasoline and water from the manhole. The proportion of gasoline to the water present varied from time to time, but averaged less than ten per cent. The water was found to be spring water, which eliminated the possibility that a leaking sewer was the source, as had been suggested.

During the period of investigation, several interesting facts were brought to light. Numerous gasoline storage tanks in the neighborhood were tested with a mercury column to ascertain if there was any leakage, and in three cases leaks were found in the systems. In one case an old tank was replaced

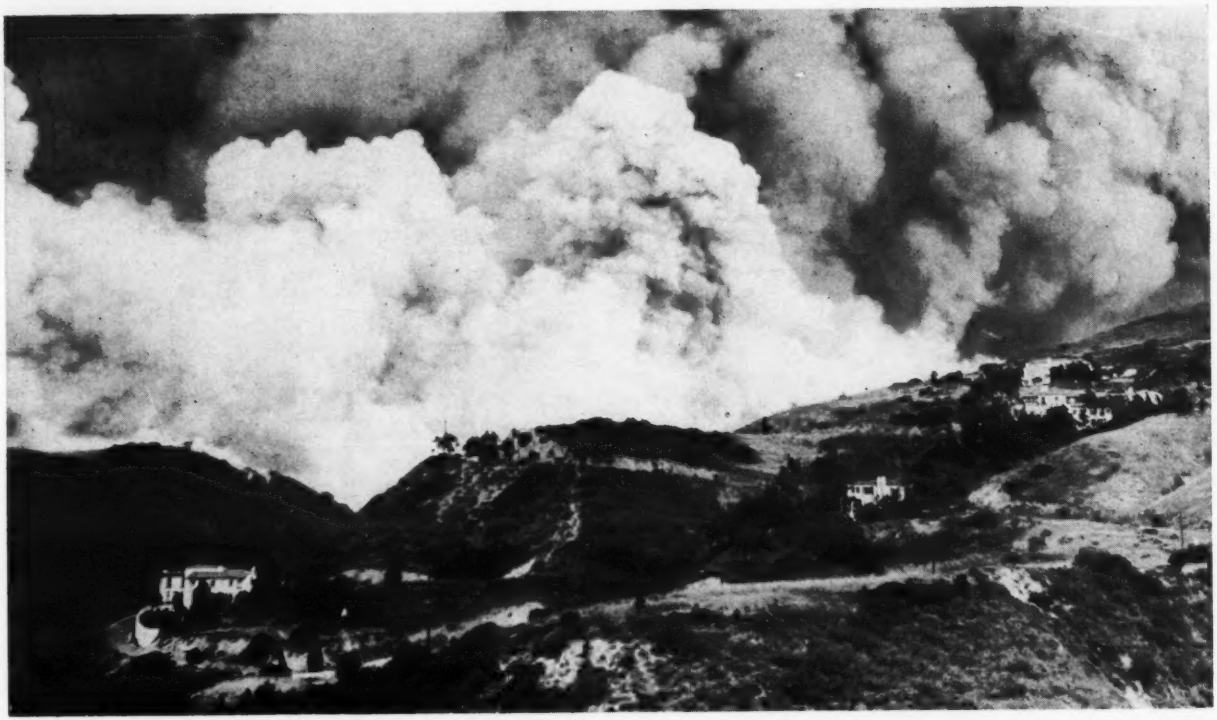


The telephone company manhole in Philadelphia, into which gasoline seeped for ten months. While workmen are preparing to encase the manhole in a specially treated concrete, the blower was used to supply them with air and to dissipate explosive vapors. The hose line passing from the manhole was used to pump out the seepage.

with a new one, but after the new tank was covered it was still found that the mercury column would not hold. Further investigation revealed that the leaks in all three systems were from corrosion of the underground vent and fill pipes. All these were replaced.

About two months ago the telephone company completed its work of enclosing the manhole. A specially treated concrete was used to prevent the entrance of fumes or liquids. The ducts in the conduit were thoroughly sealed and an additional manhole installed near by to provide natural draft ventilation to prevent any possible accumulation of fumes.

Although continued leakage indicates that all the leaks were not located, the problem is at least partially solved so far as the telephone company is concerned. Since the telephone company completed its work, there have been no traces of gasoline fumes in the conduit and there appears to be little likelihood of a fire or explosion.



Wide World.

One of the Southern California forest fires threatening valuable estates near Santa Monica.

Southern California Forest Fires.

A series of forest and brush fires in the Los Angeles-San Bernardino region in Southern California during the week of November 23 to 30, 1938, resulted in a total estimated loss, including watershed values, of $3,000,000. A combination of high winds and low humidity assisted the rapid spread of these fires. Over a hundred homes and camps in the path of the fires were destroyed. The largest building loss resulted from the destruction of the large and fashionable Arrowhead Springs Hotel near San Bernardino, with a loss of about $325,000.

One of the most serious fires started within the Los Angeles city limits in a canyon 28 miles from the metropolitan district and about four miles from the Pacific Ocean. It was caused by a caretaker of a ranch when he threw out a pile of supposedly dead ashes near the edge of some brush. A strong north wind rapidly spread the fire to the coast highway, where there were hundreds of small homes and cabins, mostly week-end places of low value. These were so close together that when one caught fire the fire quickly spread to adjoining places. This fire burned over about 15,000 acres, about two-thirds of which

Acme.

Ruins of the $325,000 Arrowhead Springs Hotel, which was in the path of the San Bernardino Mountain fire.

Acme.

Fire swept through the Santa Monica Mountains during the week of November 23-30, 1938.

Pictures, Inc.

Nine beach homes and two apartments along this main coast highway north of Santa Monica were ignited by flying brands from the mountain fires and destroyed.

Acme.

A turn in the Topanga Canyon road where a group of cottages once stood.

were within the city limits. About 3000 of these acres were burned over in the first four and a half hours. The property damage within the city limits was small, but about 116 homes and cabins in Los Angeles County were destroyed.

The fire which covered the most territory started in the forest district bordering on the north of the City of San Bernardino, when a cabin high on Strawberry Peak took fire. This fire swept down the side of the mountain so fast that it was impossible for fire fighters to make any stand. It spread east, west, and south. It was in this fire that the Arrowhead Springs Hotel was consumed, and a number of cabins in Waterman Canyon to the west were destroyed. Fire entered the city limits and threatened the residential district, but firemen soon checked it. In addition to the regular firemen and CCC crews, 1400 men were recruited to fight this fire, which destroyed 50,000 acres of watershed growth and burned for three days.

City, county, state, and federal forest agencies and fire departments fought the fires. In addition to the weather conditions, the fire fighters were handicapped by the general lack of water supplies and the mountainous nature of the territories burned. At points where even limited water supplies were available the fire departments were usually able to check the flames. Since the fires there has been considerable public interest in the need for fire reservoirs and water mains in the mountain areas, long advocated by fire officials.

Use of Standard Small Hose Couplings.

The standardization of the threads of 1½-in. and other small hose couplings was initiated by the N.F.P.A. committee on this subject in 1918, following earlier standardization of 2½-in. and larger fire hose couplings. While the standards for small hose coupling thread have been accepted as national standards, there is still considerable diversity in practice respecting the use of these standards, and the N.F.P.A. Committee on Hose Couplings and Nozzles has now developed a recommended practice for the most efficient use of the standard couplings, to permit the maximum degree of interchangeability and flexibility in fire fighting operations. A report making proposals on the subject was submitted to the N.F.P.A. at the 1938 annual meeting (Proceedings, 1938, page 191), but final action was deferred for a year in order to give all those interested an opportunity to register their views. The specific proposals made by the committee are printed below.

Proposals for Recommended Good Practice.

1. That all 1½-in. fire hose couplings shall have the 1½-in. American (National) Standard thread. (Male thread 1.990 in. outside diameter and nine threads per inch.) See pamphlet designated as A.S.A. B 33.1-1935 entitled "American Standard Hose Coupling Screw Threads. For all connections having nominal inside diameters of ½, ⅝, ¾, 1, 1¼, 1½, and 2 inches."

NOTE: The above pamphlet may be obtained from the American Society of Mechanical Engineers, 29 W. 39th St., New York. The dimensions of the coupling threads in the various sizes also appear in the N.F.P.A. Hose Manual, and in other publications.

2. That all fire hose smaller than 1½ in., *except so-called "booster" or chemical engine hose (¾-in. and 1-in. sizes)*, shall be either ¾-in. or 1-in. in size (commonly known as garden hose) with ¾-in. couplings having threads conforming to the National Standard as given in the above-mentioned A.S.A. B 33.1-1935. (Male thread 1 1/16-in. diameter with 11½ threads per inch.)

3. That all so-called "booster" or chemical engine hose for fire department service shall be either ¾-in. or 1-in. in size with ¾-in. couplings having the *¾-in. chemical engine thread* specified in A.S.A. B 33.1-1935. (Male thread 1.375 in. diameter with eight threads per inch.)

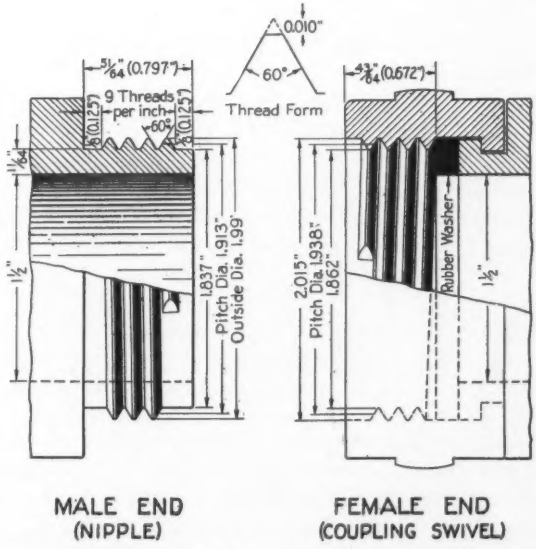
4. That the tips of all 2½-in. shut-off nozzles and play pipes shall have the 1½-in. American (National) Standard thread. If the shut-off nozzle involves a play pipe and a detachable shut-off portion, the male thread of the play pipe shall also have this 1½-in. thread.

5. That the tips of all 1½-in. shut-off nozzles and play pipes shall have the 1½-in. American (National) Standard thread. If the shut-off nozzle involves a play pipe and a detachable shut-off portion, the male thread of the play pipe shall also have this 1½-in. thread.

6. That the nozzles on all so-called "booster" or chemical engine hose for fire department service shall have their tips threaded to permit extension of hose lines by means of garden hose, i.e., the tip thread shall be the ¾-in. American (National) Standard male thread (1 1/16-in. diameter with 11½ threads per inch in accordance with A.S.A. B 33.1-1935.)

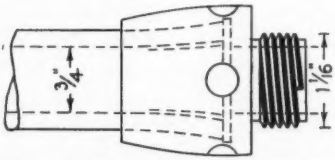
The use of the standard thread for 1½-in. coupling as first adopted by the N.F.P.A. in 1920 is, according to these proposals, recommended for all 1½-in. fire hose for both public and private use. Studies made of fire department practice indicate that this national standard hose coupling is gradually supplanting other forms, such as the so-called iron pipe thread (for report of survey see QUARTERLY, April, 1937, page 319). While there is not the same need for interchangeability between the equipment of fire departments in different communities in the case of 1½-inch as in the case of 2½-inch hose, the National standard coupling is being recognized on its merits as a substantial coupling of rugged design with coarse threads to withstand the rough usage of fire fighting. The characteristics of this 1½-inch coupling are given in the illustration below.

There is also a large use by fire departments of ¾-inch hose. Many fire departments similarly use 1-inch hose. For these small sizes there are two thread standards for the couplings, one the N.F.P.A. standard adopted in

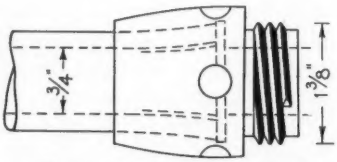


National Standard 1½-in. Fire Hose Coupling.

1920, which is interchangeable with garden hose and is commonly referred to as a garden hose coupling, though the rugged design of this coupling should not be confused with that of the cheap couplings often found on commercial garden hose. The other is the chemical engine hose coupling thread, originally developed by manufacturers for chemical engine hose, but retained in the same form for so-called booster hose for use in connection with booster pumps which are now largely supplanting the chemical tanks on fire apparatus. These two couplings are shown below in outline form.



Garden hose type threads on coupling for ¾-in. booster hose. This rugged coupling should not be confused with that found on commercial garden hose.



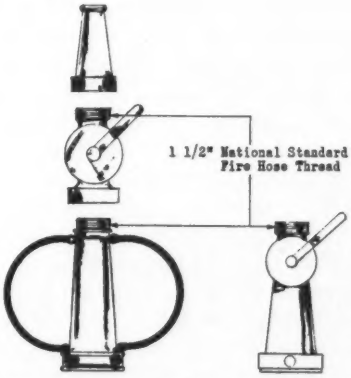
Chemical engine hose coupling for ¾-in. booster hose. When used with 1-in. hose, nipple is bored larger. This drawing is about half actual size.

The weight of precedent lies on the side of the use of chemical engine hose thread, which is commonly supplied by manufacturers when the purchaser does not specify the thread. An N.F.P.A. survey in 1937 showed that 62.9% of fire departments use this thread for booster or chemical hose couplings. It has no inherent advantage over the garden hose thread in respect to design. Both threads are sufficiently rugged to withstand the rough handling of fire fighting use. Many fire departments now use on their booster hose equipment couplings having the so-called garden hose thread, which they find to be of advantage in certain rural and suburban operations, as in the case of grass fires where garden hose may be used to extend booster lines or where the only way to connect to available water supplies is by means of the garden hose outlets on buildings. The city of Boston uses the garden hose type coupling thread for all booster hose and in many large metropolitan departments a length or two of garden hose is carried. The 1937 survey showed that 43.3% of fire departments use garden hose thread directly or provide adapters to connect with this thread.

There is some difference of opinion in the committee as to what should be standard practice. While some members recommend, in the interest of consistency and the eventual convenience of having only one standard coupling thread for one size hose, that the garden hose coupling thread should be used for the couplings of all ¾ and 1-inch hose, the majority have endorsed proposals Nos. 2 and 3 which call for the use of couplings having the chemical engine

thread for all booster equipment on municipal fire apparatus and the use of the garden hose thread for couplings for all other fire protection use.

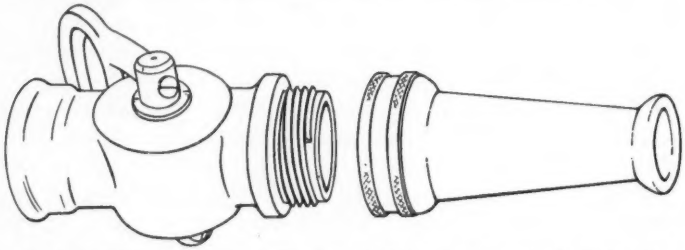
In fire department practice there are many occasions for extending large hose lines by connecting lengths of smaller hose to the end of the large line. It is common practice in many fire departments to connect a few lengths of 1½-inch hose to the end of a 2½-inch line for use in fighting fires inside residences and for other purposes where the ease of manipulation and the smaller amount of water discharged make the 1½-inch line preferable. The connection of 1½-inch lines to the end of 2½-inch hose is particularly indicated in rural or suburban areas where water must be pumped for long distances and the 2½-inch hose for the main length of the line offers the advantage of lower friction loss. Many departments are able to follow this practice without having to provide special reducing fittings by the simple method of having the tip of the shut-off nozzle on the 2½-inch hose equipped with National Standard 1½-inch hose thread rather than with some special type of nozzle thread. The N.F.P.A. committee recommends this as standard practice in their Proposal No. 4. The appearance of this nozzle arrangement is shown in the illustration below. The committee is unanimous in its recommendations on this proposal and there is no record of any objections.



Nozzle tips with 1½-in. National Standard fire hose thread used with 2½-in. nozzles.

Similarly in Proposal No. 5 the committee recommends that nozzles for 1½-inch hose should have their tips equipped with the same 1½-inch thread. This permits extending a line of 1½-in. hose by removing the tip of the shut-off nozzle and connecting additional lengths. This operation can be performed without shutting down the line, which is often important where it is

desired to keep in operation a second 1½-inch line which is taken off the same 2½-inch line. This arrangement has the added advantage of making the nozzle tips interchangeable for 1½-inch and 2½-inch hose. This may be of practical value in cases where for special reasons it is desired to use larger than the usual tip on a 1½-inch line or an unusually small tip on a 2½-inch nozzle. The appearance of a 1½-inch shut-off nozzle with a tip also having 1½-inch thread is somewhat different from the conventional nozzle design, but is entirely practical, as appears from the following illustration.



1½-in. nozzle with tip threaded with 1½-in. fire hose thread, so that tips of 1½-in. and 2½-in. nozzles are interchangeable.

As a further detail to permit flexibility in operations, the committee recommends in Proposal No. 6 that the nozzles of booster or chemical hose lines have their tips threaded to permit extension of lines by means of garden hose. There is some difference of opinion on this proposal voiced by those who are opposed to recognizing both the chemical engine and so-called garden hose couplings and who feel that only a single type of coupling should be recognized as standard for ¾-inch hose lines.

The committee expects to submit these several proposals for final action by the Association at the 1939 annual meeting and prior to such action will appreciate receiving comments and criticisms from all those interested in this subject. Such comments should be addressed to the chairman, Mr. R. W. Hendricks, 207 East Ohio St., Chicago.

State Programs for Firemen's Training.

A 1939 Survey.

By Horatio Bond, Chief Engineer,
National Fire Protection Association.

This month over 200 fire chiefs, drillmasters, federal and state educational authorities and others engaged in fire department instruction work will gather at Memphis, Tenn. The occasion is the eleventh annual session of the Fire Department Instructors Conference, a gathering sponsored by two active N.F.P.A. members — Richard E. Vernor, Manager, Fire Prevention Department, Western Actuarial Bureau, and Chief Irby Klinck of the Memphis Fire Department. Most of those who attend will be from the Middle West and Southwest. Last year more than 25 states were represented.

This impressive meeting is one evidence of the current importance of the firemen's training programs which, operating on a state-wide basis, last year reached over 50,000 firemen and engaged the attention of many N.F.P.A. members. The schools have already been recognized as of incalculable importance in making it possible for firemen to save more lives and property and to advance the all-around efficiency of fire departments.

In Arkansas and Tennessee state-wide firemen's training programs were undertaken for the first time during 1938. In Nebraska and Rhode Island a central state school session was held for the first time and may be the beginning of state-wide programs there. In the province of British Columbia regional firemen's schools have been held for a number of years. This year a provincial fire college was held for the first time. In Quebec the fire marshal's office has long made a practice of sending two inspector-instructors to visit 260 cities under the jurisdiction of the Fire Prevention Act. These inspector-instructors give a type of instruction similar to that now being provided in some of the States through itinerant instructors. At the summer meeting of the Maritime Fire Chiefs Association a training program for New Brunswick, Nova Scotia and Prince Edward Island was discussed. In Ontario the provincial fire marshal's office and University of Toronto have been working with the Dominion Fire Chiefs Association to set up a program in that province.

In 1937 the State of Maryland put Robert B. Criswell of the Ohio Inspection Bureau in charge of its training program. Professor Criswell has made a remarkable record, greatly increasing the scope and effectiveness of the Maryland program. This year Wisconsin has taken a similar step, securing the services of James W. Just. Like Professor Criswell, Chief Just is an experi-

The drill tower of the Memphis Fire Department, scene of the annual conference sponsored by the Fire Prevention Department of the Western Actuarial Bureau for fire department instructors and fire training leaders. Much of the work of firemen's training programs must center around a drill tower. Such towers are indispensable in instructing men in hose and ladder work. The Memphis tower is typical of the better type of such structures available in the more progressive cities. It is arranged so that scaling ladder work may be performed on one side of the building. There is an inside stairway and an outside stairway. Men are shown in the picture operating fire streams from fire escapes as at an actual fire. Yard space around the tower is sufficient so that long ladder trucks may be successfully maneuvered.

enced fire department instructor, one of those who served on the staffs of a number of insurance inspection bureaus in the Middle West.

Pennsylvania has set up a State Public Service Training Institute of which Rollin B. Posey is Principal. California has completed its first year under the new training set-up, of which Chief David F. Glines, formerly of the City of South Gate Fire Department, is in charge. In Nevada and Wyoming, instructors from the Los Angeles Fire Department have worked on an itinerant basis in many fire departments. Colorado will supplement its annual short course through the employment of an itinerant instructor during 1939. Only a few states such as Idaho, New Hampshire, Vermont, Montana and South Carolina, and such of the Canadian provinces as were not mentioned above, are without programs at present.

The vitality of interest in firemen's training work is shown by the fact that there are active associations of drillmasters and fire department instructors meeting regularly in Connecticut, Massachusetts and Virginia. In Texas the instructors are kept posted through a quarterly bulletin service from the Texas A. & M. College, where the annual school is held. Some of those attending the Memphis conference a few years ago organized the International Association of Fire Department Instructors. Chief J. Ray Pence of Stillwater, Oklahoma, is Secretary. He has kept up a steady barrage of mimeographed material to their members.

Firemen's training did not receive very rapid acceptance by the fire departments of the country. In 1883, one of the first fire department drill schools (as we know them today) was established in New York City. The idea was to give firemen practice in the use of scaling ladders, to develop agility, and to accustom them to working on the upper stories of buildings. Twenty years later, firemen were still relatively untrained in the majority of fire departments in the United States and Canada. Even today we find a large city like Cleveland without a drill school. However, there are now about 500 cities in the United States and Canada with populations in excess of 20,000. Of these we find 160 with drill towers and more than 250 have some sort of training program. Every one of the cities with these drill school facilities has been generous in opening its drill sessions to firemen from neighboring cities and towns which do not have training equipment. The experienced drill masters of these cities have coöperated in most of the state-wide programs to provide training to all firemen.

In 1916, the International Association of Fire Engineers endorsed the principle of firemen's training and at their 1919 convention developed a suggested set of standard fire department drill evolutions. This was about as far as firemen's training had gone when in 1925 the first three-day course for firemen was held at the universities of Illinois and Iowa. At about this same time a number of progressive insurance inspection bureaus in the middle western

territory had added to their staffs experienced fire department instructors. These they made available without cost to the fire departments of their respective jurisdictions.

The annual short courses were immediately successful and led to the formation by the United States Chamber of Commerce of a Fire Service Extension Committee to urge the setting up of annual short courses in each of the states. This was a distinguished committee with representatives of all groups active in firemen's training and under the chairmanship of George H. Parker of the Kentucky Actuarial Bureau in Louisville, and later Clarence Goldsmith, Assistant Chief Engineer National Board of Fire Underwriters, Chicago, was successful in getting programs started in a number of states. The influence of this committee can be traced in the programs in Colorado, Florida, Kansas, Maryland, Michigan, Minnesota, Missouri, Montana, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, South Dakota, Texas and West Virginia, and possibly other states.

In 1929 Ralph J. Scott, Chief of the Los Angeles Fire Department, proposed an educational program to the International Association of Fire Chiefs and became Chairman of its Educational Committee. His own work in Los Angeles through the Los Angeles Fire College has had a pronounced influence on firemen's training throughout the Pacific and Mountain states.

In 1917, the federal government under the Smith-Hughes act set up educational machinery which was destined eventually to play an important part in the firemen's training picture. This act provided for assistance from the federal government to the various states in connection with vocational education, a type of training especially useful for factory and farm workers. Nearly every state came to have a vocational education division in its state department of education. In 1931, the United States Office of Education, in coöperation with Chief Scott of Los Angeles, made a study of the problem of firemen's training in the Los Angeles Fire Department. The vocational education departments of a number of states, notably Massachusetts, undertook to assist the training of instructors in fire departments. Other states which should be mentioned along with Massachusetts are Arizona, California, Connecticut, Delaware, Georgia, Louisiana, Mississippi, Nevada, New Jersey, New York, Oklahoma, Pennsylvania, Utah and Virginia. Prior to 1938 each of these (and perhaps the vocational divisions of some of the other states) had contributed more or less to the advancement of firemen's training work in the several states.

The George-Deen act of 1936 provided an appropriation of $4,000,000 available to the states for industrial training. The act specifically authorizes the training of public employees under this classification. The vocational education departments, having already studied firemen's training work and finding it a field in which they could register immediate results, have been able

to more effectively take hold of local training programs. More important, they have modest appropriations which may be applied to the employment of itinerant instructors and to reimbursing instructors from fire departments for traveling expenses when they are working outside their own city.

During 1938, the U. S. Office of Education set up an advisory committee of fire chiefs and fire fighters to help the work of firemen's training. Dr. Frank Cushman, known to many firemen because of his participation in firemen's training work as a part of the coöperation of the U. S. Office of Education and local departments of vocational education during the past five years, is in charge of fire training. In December, Lyman S. Moore went to Washington as Consultant in Public Service Training to the United States Office of Education. He was formerly Director of the Institute for Training in Public Administration of the International City Managers Association and brings to the job a fine background of experience and enthusiasm.

Two years ago the Institute for Training in Public Administration prepared a correspondence course in fire administration. The N.F.P.A. coöperated in the preparation of the text for this course and Assistant Managing Director Percy Bugbee serves as the instructor. This course offers training on the administrative level, something which most of the other training programs do not attempt.

Certain general conclusions might be drawn from the experience of the various states. There has been a somewhat different approach to the firemen's training problem in each. Rather than to generalize, however, there follows a paragraph or two explaining the origin, sponsorship, and current status of firemen's training work in each state. Space limitations do not make it possible to devote anything like adequate space to what many of the states have done, but enough information is given to indicate the form and direction of the program and extent to which it is actually getting the training job done.

It is to be expected that in the various drill programs variances in points of view develop between fire chiefs, drillmasters, vocational educators, insurance engineers, and other technicians who are participating in the courses offered. These differences are being harmoniously resolved in most of the states through the appointment of advisory committees embracing all these interests. The programs as most recently developed have two objectives. One of these is to provide an itinerant instructor who can visit and instruct the small town and volunteer fire departments. In the paid departments the objective is to develop one or more competent instructors. Programs in states like Massachusetts, Connecticut, Michigan and Louisiana emphasize the responsibility of the fire chief to select these instructors and see that they attend central or regional instructors' schools and then in turn carry on instruction in their own department. The state department of vocational education assumes responsibility for arranging classes and other details.

Oldest of the state short courses is that held annually at the University of Illinois, Champaign-Urbana. The above view shows a lecture session. Short courses or regional schools were held in 34 states in 1938.

There is no immediate likelihood that the vocational educators will want to dominate training in this field, because fundamentally each of these departments is just as interested in the training of other public employees. The New York State program of public service training has included, for example, such groups other than firemen as police, city clerks, assessors, water works employees, and food inspectors. Several of the vocational educational departments, as in Arizona, have started a firemen's training program and have then dropped it, awaiting further demands from the fire departments themselves for the work.

The state departments of education through their vocational divisions, however, have made important contributions in improving the type of instruction given by drillmasters. Fire department drillmasters for the most part are men of adequate practical knowledge, but without teaching experience. The vocational educators have demonstrated how to teach and especially how to make use of the conference-discussion method of instruction. This method developed in industry consists briefly of getting a group of men around a table. One of them as a leader attempts to organize the combined knowledge of the group. One limitation of this approach is that it does not bring to a group any experience or knowledge beyond that which is already possessed by those around the table. There has also been a tendency (because the vocational edu-

cators have not claimed to be fire department experts) for them to emphasize unduly the technique of analyzing jobs and conducting conferences. The annual fire schools may have lacked something in pedagogical technique, but they have had the effect of bringing together a group of persons each expert in a specific field who could give valuable instruction which would leave those attending the sessions with subject matter new to them.

It is not easy to say that the program of this or that state has progressed farther than any other. Some have of course more nearly come to grips with their problem. Programs may be measured in two ways — one, the total number of men given some sort of training, and two, the quality of the training. No such appraisal is here attempted, however. Those who wish to get a program started, or who wish to see how an existing program may be extended, will find features especially warranting study in the programs of California, Connecticut, Louisiana, Maryland, Massachusetts, Michigan, Oklahoma, Texas and West Virginia.

Data on the number of men reached by the 1938 training programs are tabulated in accompanying tables. These figures cover only the men contacted by state-wide programs as distinguished from individual training work done in some of the larger cities. If the work done by large city drill schools in their own department were included, probably an additional 8000 to 10,000 men might be added to the tabulation. Suffice it to say that practically all of the largest cities of the United States and Canada have either a drillmaster, a drill tower, or both, and a drill program of some kind. A brief survey of the 99 cities over 100,000 population shows less than a dozen cities in all which do not currently have some sort of training activity. The biggest training job in any one city is that undertaken by New York, where 1767 men were put through the probationary firemen's school in 1938. At the same time some 1978 other members of the department attended special schools for officers, motor and pump operators, fire hazard inspectors, and a school in public speaking.

The following tables summarize the programs in the several states. The blank spaces represent states where it is known that programs were conducted, but detailed data are lacking.

Minimum Class-Hours of Instruction.

As set by various states where a certificate is awarded on completion of a basic or elementary course of training in practical firemanship.

Arizona	30	New York	24
Arkansas	10	Nassau County (N. Y.)	14
Connecticut	20	Oklahoma	10
Delaware (4-year course)	144	Pennsylvania	45
Louisiana	60	West Virginia	60
Maryland	40	Wisconsin	40
Massachusetts	36		

Annual Short Courses.

	Years Held	Cities Represented	1938 Attendance
Alabama	3	11	35
Colorado	8	45	225
Florida	9	54	170
Georgia	4	70	409
Illinois	14	156	519
Indiana	5	58	415
Iowa	14	92	421
Kansas	8	41	121
Louisiana	9	37	51
Maryland	9	57	154
Michigan	10	..	200
Minnesota	11	69	182
Missouri (S. E.)	9	26	99
Missouri (Cent.)	6	130	157
Nebraska	1	98	380
New Mexico	9	26	123
New York	8	..	125
North Carolina	10	76	324
Oklahoma	13	15	20
Oregon	9	..	200
Rhode Island	1	..	100
South Dakota	9	..	700
Texas	9	245	540
Washington	8	107	533
West Virginia	8	56	234
Wisconsin	5	81	318
Wyoming	6	..	150
Total Attendance			6,796

Regional School Programs.

	No. Schools	1938 Attendance
Connecticut	19	353
Georgia	3	167
Kentucky	1	100
Indiana	106	3,500
Iowa	6	550
Louisiana	7	260
Maryland	16	322
Massachusetts	15	357
Michigan	3	57
Minnesota	9	1,687
Mississippi	1	40
Missouri	10	649
New Jersey	..	..
New York	20	1,819
North Dakota	5	941
Ohio	1	1,000
Oklahoma	2	14
Oregon	6	..
Virginia	10	275
Total Attendance		8,931

Contacts by Instructors, 1938.

	No. Cities	No. Men
Arkansas	24	231
California	..	..
Connecticut	91	2,000
Delaware	16	250
Illinois	187	2,478
Louisiana	147	1,000
Maryland	157	8,000
Massachusetts	..	940
Missouri	100	500
Nevada	23	408
New York (Nassau Co.)	54	10,856
Oklahoma	28	697
Pennsylvania	17	551
Tennessee	12	133
Texas	200	5,000
Utah	30	500
West Virginia	20	440
Wisconsin	28	550
Wyoming	10	200
		34,734

Notes on the foregoing table: CALIFORNIA. A staff of four state fire department instructors have been in the field during the latter part of 1938 and have made a large number of contacts, figures for which have not yet been compiled. NASSAU COUNTY, NEW YORK. All attendance at schools held by itinerant instructors is included in the figure given. Of these only about 700 were active students and passed the final examination of the course of seven sessions approximating 14 class-hours. OKLAHOMA. Of these, 273 men were awarded certificates for completing the introductory 10-hour course.

The handsome black and gold uniform sleeve insignia reproduced in miniature below was awarded to 322 volunteer firemen completing the 1938 training course in Maryland.

State Firemen's Training Programs.

Alabama. In 1934 and 1935 instructor training courses were held at the fire department in Birmingham and subsequently training of the same sort has been developed in a number of the other larger cities of the state in a program sponsored by the State Department of Vocational Education and the League of Alabama municipalities. In 1936 the first annual fire school was held at the fire department in Montgomery, of which Lieutenant T. H. Henderson is drillmaster. This was repeated in 1937 at Montgomery and held October 17-20, 1938, at Mobile with an enrollment of 35 men from 11 towns.

Arizona. The State Department of Vocational Education employed itinerant fire department instructors, who during 1934, 1935 and 1936, covered practically every fire department in the state. Most of the fire departments are volunteer. An introductory course in firemanship was given, consisting of three hours' instruction each evening for a two-weeks' period in each fire department, a total of about 30 hours. It was the expectation of the Department of Vocational Education that as a result of this course individual fire departments would be encouraged to set up their own training programs. By 1938, however, only the fire department at Phœnix had done so. The State Department of Vocational Education is awaiting further signs of interest on the part of fire departments before proceeding with a further state-wide training effort.

Arkansas. In May, 1938, the Arkansas State Fire College was organized by the Arkansas Municipal League. This is not an annual fire school, but a year-round program sponsored by the following agencies coöperating with the League: State Department of Education, University of Arkansas, State Personnel Department, the Arkansas Fire Prevention Bureau, State Firemen's Association, and a fire chiefs' advisory committee. An introductory course setting up the minimum essentials of fire fighting training has been drafted. Presentation of the course requires a minimum of 10 hours of actual instruction. The course is arranged so that the average fire department in Arkansas may receive the training

in three or four evenings' work. The State Department of Vocational Education has employed Assistant Chief Carl S. Smalley of Van Buren, who has given the course in twenty-four towns during 1938, with 231 firemen successfully completing this basic course. A full training course is planned for the future.

California. In 1922, 500 new men were added to the Los Angeles Fire Department, which focused attention on training and led in 1924 to the establishment by Chief R. J. Scott of special courses for officers, engineers and drivers, and to the development of instructors. These courses, largely lectures by chief officers, were more advanced than the usual elementary instruction and were known as the "Fire College."

The Fire College was given the necessary equipment and facilities at fire headquarters in Los Angeles, with the result that it was able to do a creditable instruction job among Los Angeles officers and firemen. In 1929 a class of fire chiefs from southern California cities was given an intensive course of 37 lectures at the Fire College. Other men from fire departments in southern California and elsewhere attended the Los Angeles Fire Department class at one time or another. In 1931 the Federal Board for Vocational Education selected Los Angeles as the city in which to make a study of the fireman's job and the general problem of firemen's training to appraise the possibilities of this field of vocational education.

As a result of this development and because there are many progressive fire departments in California, it is not surprising that there has been a lively interest in a program of firemen's training for the state. In 1932 the Commission for Vocational Education of the State Department of Education assigned an itinerant instructor, J. F. Baker, chosen from the Los Angeles Fire Department. He was able to establish a training program in numerous departments throughout the state. The plan followed was first to conduct in each fire department a five-session conference with the officers. Supplementing these officers' conferences, vocational instructor training was conducted in a number of departments. Special courses covering fire department organization, use of equipment and care of quarters and equipment, were developed for the use of instructors. As instructors were trained they were encouraged to develop their own local training program.

The City of Pasadena, one of those which had established its own training course in conformance with the state plan, as a result worked out the following procedure on handling new men. Instead of assigning them to a company or to the drill tower, they were turned over to a trained instructor for a period of two weeks. During this time they were not required to perform station or fire duty of any kind. The entire time, eight hours a day, was spent in training conferences of the instructor and new men. This plan was believed to result in a man reaching in only two weeks a better degree of orientation in his new job than he ordinarily would obtain from some six months under former methods of training.

With the availability of George-Deen funds the state program of firemen's training was reorganized in 1938. A staff of four full-time instructors of fire training was provided by the Commission for Vocational Education under the direction of David F. Glines, Supervisor, who was formerly chief of the fire department of the City of South Gate. He is assisted by Messrs. Cecil M. Lochard, Thomas H. Ward and John S. Steinhauer. These men operate under the direction of a state advisory committee, the personnel of which consists of two fire chiefs from southern California cities, two chiefs from northern California cities, four members of the California State Firemen's Association, and representatives of the California League of Municipalities and the Board of Fire Underwriters of the Pacific. The State Fire Marshal and the Chief of the Bureau of Trade and Industrial Education are also members of this advisory committee. The present program in California has the general objective of getting each fire department to set up its own training procedure. During 1938 the staff of instructors has devoted much of its time to training instructors in cities on the San Francisco peninsula, Pasadena, Long Beach, San Bernardino, Alameda and six other smaller cities in Los Angeles County. Data on the number of men in these classes for 1938 have not yet been compiled.

Colorado. Since 1931 the Colorado State Firemen's Association has held a 2-day fire college in connection with its annual convention. Professor Don C. Sowers of the University of Colorado, who is Secretary of the Colorado Municipal League, has served as Director of this annual college. At the 8th Fire College, held July 20-21, 1938, at Brighton, the attendance was 225 firemen from 45 cities and towns. The 1939 Educational Committee of the State Firemen's Association under Captain W. A. Carlin of the Denver Fire Department has arranged with the State Department of Vocational Education for the employment of former Assistant Chief V. E. Roberts of Denver as an itinerant instructor.

Connecticut. In 1936 a committee of the Connecticut Fire Chiefs Club, headed by Chief John C. Moran of Hartford, arranged with the State Department of Education to set up a firemen's training program. Herman S. Hall, State Supervisor of Trade and Industrial Education, in coöperation with James A. Coxen of the U. S. Office of Education, administered the first drillmasters' training school in 1936. The state program provided that admission to the drillmasters' training school and to regional firemen training schools set up thereafter would be limited to members of fire departments officially assigned to the work by their respective fire chiefs.

The first drillmasters' conference in Hartford in October, 1936, developed a staff of 19 qualified fire department instructors. There are now 25 such instructors from a total of 19 cities who have formed the Connecticut Fire Department Drillmasters Association and hold regular meetings.

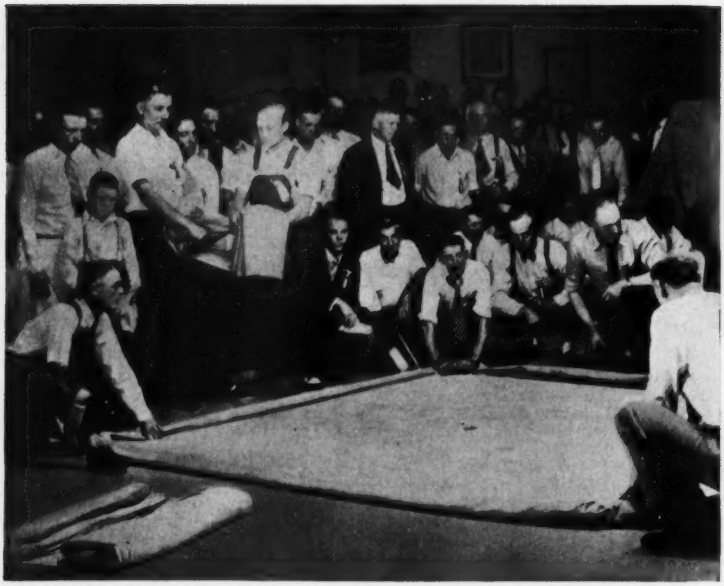
This association has developed an elementary and advanced course in hose and ladder work. During 1938 the elementary course was given at 10 regional schools to 204 men. This course embraces 10 sessions, usually one two-hours or longer session each week, for 10 weeks. A similar advanced course was given at 9 regional schools to 149 men. The men in these courses represent 91 fire departments, and the 353 graduates of regional schools acted as instructors in departmental schools to approximately 2000 firemen.

Delaware. In 1933 the State Vocational Education Board conducted courses in each of the three counties of the state with the idea of developing fire department instructors. All except one of the fire departments in the state are volunteer. At present seven instructors are serving part time, holding training classes in 16 different fire companies, which is approximately one-third of all the fire companies in the state. The training program covers four years. One 3-hour training session per week for twelve weeks is given each year. Diplomas are given to those completing the 4-year course, which represents the completion of a total of approximately 144 hours of training. During 1938 approximately 250 firemen participated in this course.

Florida. In 1930 and each year since, the Florida State Firemen's Association has sponsored an annual fire college, which has been held at Daytona Beach. The 9th annual session, held July 8-21, 1938, had 170 firemen present from 54 cities and towns. Chief J. F. MacMillan, of the Cocoa Fire Department, serves as General Manager. The State Board for Vocational Education has also conducted some classes in the fire departments of Jacksonville, Miami, and other cities.

Georgia. An annual fire college was sponsored in 1935 by the Georgia State Association of Fire Chiefs. The college has been functioning under a board of directors of eight chiefs with Harry Phillips, assistant fire marshal of the City of Atlanta, as director. At the 4th Annual Fire College held at Atlanta, May 4-7, 1938, 400 firemen were present from 70 cities. During 1937 and 1938 this annual state fire college has been supplemented by three zone schools. In 1938 zone schools were held with attendance as follows: Macon 82, Rome 48, Athens, 37. The zone school program is financed by the State Department of Education, using four instructors developed at the annual school.

Thomas H. Quigley of the Georgia School of Technology and Vice-President of the American Vocational Association, has been active in studying and promoting firemen's training work. He was influential in the joint efforts of the state boards for vocational



Courtesy Clinton Turnbull.

Class in salvaging operations at the Fire College of the Colorado State Firemen's Association. Over 200 men attend sessions of this school, which has been held annually since 1931. In 1939, the annual school will be supplemented by the work of an itinerant instructor.

education of Georgia, Arkansas, Louisiana, Oklahoma and Texas, in developing a standard fire fighters vocational school course of study, a standard credit card and standard diploma. He assembled a list of texts available for firemen's training work which was published this year. Of 213 texts listed as suitable for use with firemen's training classes, it is interesting to note that 168 items were publications of the National Fire Protection Association. Mr. Quigley has been applying his standard fire fighters course in the Atlanta and Augusta Fire departments. In Atlanta, two groups of officers, 24 men in each, and two groups of privates, 34 and 35 men respectively, have held 48 hours of class work during 1938. The men meet for two 2-hour sessions a month. In Augusta a group of 20 men from January to May met for 82 hours and a second group meeting September to December met for 54 hours. Two 2-hour meetings per week were held. Standard diplomas were awarded in 1938 to 29 firemen in Atlanta and 19 in Augusta.

Idaho. In 1931 Chief Ralph J. Scott of Los Angeles furnished the faculty of his fire college to put on a 3-day short course at Pocatello. This appears to be the only formal training attempted on a state-wide basis in Idaho. The chiefs and firemen from quite a number of cities in the state have found it convenient, however, to attend the school run each year by the Washington State Firemen's Association.

Illinois. Credit for establishing the first short course for firemen is generally given to Illinois. In 1925, the Illinois Firemen's Association, Roy W. Alsip of Champaign, Secretary, and State Fire Marshal John G. Gamber, secured the interest of the University of Illinois in promoting a school at the twin cities of Champaign-Urbana. Coöperation was also given by Clarence Goldsmith, Assistant Chief Engineer of the National Board of Fire Under-

In more than 24 states full-time instructors, experienced firemen, are provided by the state vocational training department, state fire marshal's office, insurance inspection bureau, state university or other agency. These men are available to fire departments to conduct conferences or drills.

writers at Chicago, the Illinois Inspection Bureau, and R. E. Vernor of the Western Actuarial Bureau. Drill work at the school has generally been under the direction of Chief Harry K. Rogers of the Western Actuarial Bureau.

To start the first school, State Fire Marshal Gamber made a trip to round up speakers of national prominence in the fire field and put on such a good program that response of the fire departments to it was immediate. In 1926 the firemen's association secured an appropriation from the state legislature of $11,000 for the erection of a drill tower at the University of Illinois. In 1931 an additional appropriation of $9000 was obtained to finish it. Funds for the school have been variously received from direct state appropriations, the University of Illinois, and the state fire marshal's office.

The school ran for a number of years principally as a lecture course, but it was soon realized that all of those attending were not interested in the identical instruction. Also firemen who had attended early sessions of the school wanted new subject matter. By 1934 four separate programs were offered, one for pump operators, one for inspectors, another for instructors, and the fourth a general school for those attending for the first time. In 1936 the school offered separate programs for volunteer firemen, for paid firemen, and an advanced course. The program of the 14th fire college, held June 14-17, 1938, consisted of general sessions primarily for volunteer firemen and advanced sessions covering subjects principally of interest to paid fire departments. In all, 519 firemen were present from 111 volunteer fire departments and 46 paid departments.

There are approximately 11 district organizations of fire departments in the state. By 1935 a number of these were holding informal regional fire schools patterned after the state school in connection with their regular meetings. In 1937 the late State Fire Marshal, Sherman V. Coultas, assigned two deputies of his department to serve as itinerant instructors to the fire departments of the state. The deputies, Thomas R. Brooks and Thad Fife,

both former chiefs, have been able to contact a large number of firemen, supplementing the annual fire school course. Incomplete figures for 1938 show that these two men visited 187 fire departments and drilled 2478 firemen. Local drill and instruction work is varied according to the needs and interest of the local departments.

Indiana. In 1933 Carl S. Steup, engineer of the Indiana Inspection Bureau, prepared an outline of basic instruction for fire departments which has been widely used. The bureau furnished Mr Steup on request as a fire department instructor and from that date until his death in 1938 did much to advance the general program of firemen's training in the state. At about the same time Clem Smith, Indiana state fire marshal, assigned a staff of men who served as itinerant instructors giving training at various regional schools around the state. This program is in charge of Archie McCabe, Director of Education, assisted by former Chief J. J. O'Brien of Indianapolis as Chief Instructor, and a staff of deputies. In 1934 a section meeting of the American Water Works Association was held at Purdue University in connection with which the 1st Indiana Fire School was held. The Engineering Extension Department of Purdue University assumed responsibility for this annual school in coöperation with the Indiana Fire Chiefs Association, the Indiana Firemen's Association, the Northern Indiana Industrial and Volunteer Firemen's Association, the State Fire Marshal Department, and the Indiana Inspection Bureau. W. A. Knapp, Assistant Dean of Engineering, is director of the school.

Before his death Mr. Steup gave instruction during 1938 to fire departments in some 18 different cities and towns. Fire marshal's instructors held 106 regional fire schools, at which firemen from 386 towns participated, with a total attendance of 3500 firemen. The 5th Annual State Fire School was held at Purdue University, Lafayette, October 18-20, 1938. It was attended by 415 firemen, representing 58 fire departments.

Iowa. Iowa shares honors with Illinois for being among the first with an annual school, having established the Iowa Fire School in the same year, 1925. Then and subsequently it was held at Ames under the supervision of the Engineering Extension Service of Iowa State College. The State College published and circulated widely many of the papers presented at each of the annual schools. Lindon J. Murphy of the Engineering Extension Service is currently director of the Iowa Fire School. The annual fire school at Ames in May 25-28, 1938, was attended by 421 men from 92 fire departments.

Coöperating in the training program are the Iowa Firemen's Association, the Iowa Association of Fire Fighters, Iowa Fire Chiefs' Association, the State Fire Marshal and the Iowa Insurance Service Bureau. The Iowa Insurance Service Bureau also employed a fire department instructor during the period 1929 to 1933. Captain Rudolph Tersch and later Captain H. E. Jurgenson, both of the Minneapolis Fire Department, served in this capacity.

In 1934 the annual fire school was supplemented by a district fire school held at Red Oak. The 1938 program of the district fire schools included sessions during October at West Union, Tipton, Fairfield, Emmetsburg, Manilla and Mount Ayr, which were attended by 550 men from 117 fire departments.

Chief H. J. Callahan of Fort Dodge, chairman of the Educational Committee of the Iowa Fire Chiefs' Association, announced in December that the state vocational education department is arranging a 10-week course of training along the lines of the Massachusetts program.

Kansas. A fire college was first established at the University of Kansas at Lawrence in 1929. Sessions were held annually through 1933 and resumed in 1936 after being omitted in 1934 and 1935. The annual sessions were held at Lawrence, September 12-15, 1938, with a program attended by 121 firemen, representing 41 departments.

The program is under the direction of a fire school committee of the Kansas State Firemen's Association in coöperation with the Kansas State Board for Vocational Education and the University of Kansas. E. J. Stewart, Chief Engineer of the Kansas Inspection Bureau, serves as secretary of this committee.

Kentucky. The Kentucky Actuarial Bureau, of which George H. Parker is Manager, was apparently the first of the Middle West insurance inspection bureaus to employ a fire department instructor. Their first instructor was Captain Henry G. Stilz of the Louisville Fire Department, who served from 1921 to 1923. He was followed by Captain Harry J. Cline of the Chicago Fire Department, who served until March 1924. Captain S. G. Render of the Louisville Fire Department served from 1924 until 1933, when he returned to the Louisville Fire Department, shortly after which he became Assistant Chief.

In 1931 the northern Kentucky group of the Kentucky Firemen's Association held a short course at Newport, Ky., which was conducted by Captain Render, assisted by local Kentucky fire chiefs and several fire department officers from Cincinnati. In 1935 the Kentucky Municipal League and the Kentucky Firemen's Association induced the University of Kentucky at Lexington to put on a 3-day school. In the same year regional schools were held at Hopkinsville and Madisonville. The University of Kentucky school was also held during 1936 and 1937. Criticisms of the annual short school were registered by the Kentucky Firemen's Association. Some of its members considered the sessions too technical for volunteer fire departments and many small paid departments.

Assistant Chief Render of Louisville is the Chairman of the Educational Committee of the Kentucky Firemen's Association. The committee met this year with University of Kentucky officials and recommended that an itinerant instructor be employed by the state in order to carry simple training in fundamentals to the fire departments of the smaller communities. This plan is currently awaiting a state appropriation so that it can be carried out. The 3d annual regional school was held at Madisonville, Ky., in March, 1938, under the direction of Harry K. Rogers of the Western Actuarial Bureau. The 2-day session was attended by approximately 100 firemen from some 25 cities and towns.

Louisiana. The Louisiana State Firemen's College was established in 1931 by the Louisiana State Firemen's Association with the coöperation of the Louisiana Rating and Fire Prevention Bureau, the Division of Trades and Industrial Education of the Louisiana State Department of Education, and the General Extension Division of the Louisiana State University. The school is under the direction of a Board of Supervisors, consisting of Chief R. A. Bogan, Chairman, Baton Rouge, Mayor T. E. Wright, Secretary, Houma, Chief S. J. Flores, Shreveport, Chief John M. Evans, New Orleans, and Chief Frank J. Roddy, Monroe.

The school was run as a short course until 1935, when it was held primarily for instructors. In 1936 the Board of Supervisors got out a 200-page illustrated Manual of Instructions for Fire Departments, which outlined a minimum amount of basic training for the fire departments of the state. The manual made it possible for the school to put into effect a program designed to secure a minimum of 60 hours' training in every fire department of the state. The annual school was limited to instructors and in addition 11 regional instructors' schools were established. A short course for instructors was held at each of the regional centers, consisting of 3 hours instruction every evening for five days. The Board of Supervisors adopted rules, on the basis of compliance with which, school certificates were issued to local fire departments and firemen.

Louisiana has approximately 105 volunteer departments and 12 paid or part paid departments. To qualify, each of these must develop an instructor from among its own personnel and hold regular drills. These drills must be held not less than every other week with a minimum total of 5 hours' instruction in evolutions per month. The training must follow the state Manual. The chief of the fire department is required to attend all drills and take charge of the drilling, assisted by the drillmaster or instructor. The quality of drill work is checked because the Board of Supervisors designates an inspector to visit each department. He reports on the training program on a detailed form, copies of which go to the Board of Supervisors and the Louisiana Rating and Fire Prevention Bureau. In addition, the local department submits a monthly instruction report, both for the company and for each man, copies of which are sent to each of the above agencies and also to the State Supervisor of Trades and Industrial Education and the Director of the General Extension Division of the Louisiana State University.

Under this training plan approximately 1000 firemen in the state receive training during the year. Fifty-one instructors from 37 cities attended the 9th Annual Short Course at Baton Rouge April 18-23, 1938, and approximately 260 attended instructor training sessions at 7 zone schools held during the year.

The training school program has been financed for the most part by special state appropriations. Men serving as fire department instructors under this program are paid a salary of $7.50 per day. Traveling or other expenses are paid by the Louisiana State Firemen's Association.

Maine. The Maine Fire Chiefs Association sponsored a program of fire schools in 1934. An instructors' school was held at Portland with the coöperation of the State Department of Vocational Education and regional schools were held at Portland and Biddeford that year. This marks the State of Maine's sole entry into the training field, although the Educational Committee of the fire chiefs' association and the state fire marshal's office are still working on the possibilities of a permanent program.

Maryland. In 1930 Walter R. Hough, former Baltimore Fire Commissioner, and the Maryland State Firemen's Association induced the College of Engineering of the University of Maryland to arrange a four-day annual short course at College Park. The work was placed under the direction of Dean S. S. Steinberg, who subsequently enlisted the aid of Sherwood Brockwell, State Fire Marshal of North Carolina, to serve as presiding officer at many of the school sessions, which were held each year thereafter. Certificates were issued at the 1938 school, held September 6-8, to 154 firemen from 57 fire companies.

From 1930 to 1937 R. B. Criswell, engineer of the Ohio Inspection Bureau, served as an itinerant instructor and at the fire schools in Ohio and West Virginia. He developed an introductory course pertaining to practical firemanship for small departments. In 1937 he was brought to Maryland and put in charge of a permanent year-round program of fire-

men's training. Funds for this program were made available by the State Legislature and supplemented by others from the Vocational Education Division of the State Department of Education. Mr. Criswell was made professor on the staff of the University of Maryland and has been assisted in his work by four regional instructors who work on a part-time basis: Deputy Chief Thomas G. Basil of Annapolis, Simon Clopper of Smithsburg, Curtis G. Larrimore of Easton, and Chief John H. O'Lexey of Jessup.

Professor Criswell instituted his basic training course, consisting of 20 weekly lessons of about 2 hours each. In 1938 this was studied by 16 groups of fire department officers and men. In all, 322 members from 78 fire companies completed the course. Professor Criswell and his associate instructors also conducted drills in many other towns, contacting practically every one of the 10,000 firemen in the state. A large amount of mimeographed instruction material has been prepared by Professor Criswell, including a handbook covering the introductory course in firemanship and a compilation of all the laws pertaining to fires, firemen, fire departments in the state.

Massachusetts. In 1933 a state-wide program of firemen's training was advanced by the Fire Chiefs Club of Massachusetts and a number of coöperating organizations, including the Massachusetts State Firemen's Association, the Fire Prevention Committee of the Massachusetts Safety Council, the State Fire Marshal's Office, the State Department of Agriculture, the Massachusetts Farm Bureau Federation, the New England Fire Insurance Exchange and the N.F.P.A. The Vocational Division of the State Department of Education undertook the operation of the program.

Beginning with an instructors' conference in the summer of 1933 a staff of 43 drillmasters has been developed from the various fire departments of the state. Training on a state-wide basis has been given at some 15 zone centers. Zone school courses consist of 12 weekly sessions, usually 2 hours each on Saturday afternoons. During 1938 357 men attended these zone schools. These drillmasters have organized the Massachusetts Fire Department Instructors Association, which holds monthly meetings.

During 1938 Captain George Murray of the Brookline Fire Department was employed by the Vocational Division of the Department of Education for a three-months period as a full-time instructor-supervisor. He worked from the State House, organizing, supervising, and instructing in the schools of local fire departments. Captain Lawrence Lynch of Brockton and Lieutenant Ward G. Whalen of Pittsfield served successively in the same capacity. The Department of Education expects to continue to use various instructors in three months full-time training periods to accomplish the double purpose of making instruction available to volunteer and part-paid fire departments and at the same time obtaining valuable instruction experience for all the drillmasters of the principal cities of the state. These instructors have reached 940 firemen through special local schools during 1938.

Michigan. The possibilities of an annual school for firemen in Michigan had been pointed out as early as 1919 by R. C. Loughead, Chief Engineer of the Michigan Inspection Bureau. The following year the state fire marshal and Chief Hugo Delfs of Lansing consulted the dean of engineering at Michigan State College regarding a state training school to be established at East Lansing. It was not until 1928 that the Michigan State Firemen's Association voted to sponsor an annual school, the first one of which was held at Sault Ste. Marie under the sponsorship of the Michigan State College. This school took the place of the usual firemen's convention, and has been held each year since.

A program of regional schools was also undertaken, in 1933 seven regional schools being held. These schools were sponsored by the Michigan Fire Chiefs Association, the Michigan State Firemen's Association, the Michigan Municipal League, and the state Fire Marshal, and were conducted under the auspices of the Engineering Extension Division of Michigan State College. Charles V. Lane, Secretary of the Michigan State Firemen's Association and Assistant State Fire Marshal, became director of the state fire college and regional schools. The expenses of the schools were relatively small and were largely defrayed by the Michigan Municipal League. Ten regional schools were held in 1934 and six in 1935. In connection with the latter, a Fire Fighters Manual was prepared, largely the work of

Drill Squad group at the Fire College of the North Carolina Firemen's Association. In the center (with brass buttons) is Chief A. L. Duckett of Asheville, host to the school. At his left is Sherwood Brockwell, State Fire Marshal and director of the college. Chief Brockwell has also conducted sessions of state fire schools of South Carolina, Maryland and Virginia.

Professor Thomas Diamond of the School of Education of the University of Michigan. At about that time interest in regional schools apparently petered out, as only two schools were held in 1936 and none in 1937.

In the fall of 1937 the firemen's training problem was attacked from a new direction. A State Advisory Committee on Firemen's Training was made up of seven fire chiefs, the state fire marshal, and representatives of the Michigan Inspection Bureau, University of Michigan, the Michigan Municipal League, and the State Department of Vocational Education. This committee decided to adopt in 1938 a program substantially identical with that followed in Massachusetts. In March 1938 three regional instructors' conferences of 6 days each were held, attended by 57 men from 32 departments. This new program is under the direction of J. W. Parry, Assistant State Supervisor for Public Service Training. Mr. Parry plans to develop a staff of qualified drillmasters from the fire departments of the state and to make these instructors available for instructional work to the volunteer and part paid departments. The State Department of Vocational Education, through federal funds made available by the terms of the George-Deen act, pays travel and living expenses of instructors on this work. Mr. Parry also hopes to organize some meetings of chiefs and other high fire department officers for training in matters of fire department administration as distinct from the elementary training, which would otherwise be the principal activity of the program.

The annual fire school was held as usual during 1938 at Sault Ste. Marie June 20-23, with 200 firemen attending a 4-day course. The annual school and also regional schools will be continued, these being believed to have some value in promoting interest in firemen's training work on a state-wide basis.

Minnesota. The 1st Annual Northwest Fire School was held in Minneapolis in August 1928. It was a 3-day short course conducted jointly by the University of Minnesota, the State Fire Marshal's Department, and the League of Minnesota Municipalities. The school

in this and succeeding years drew wide attendance not only from Minnesota but from North and South Dakota, Wisconsin, and Canada. Chief George Lochard, drillmaster of the Minneapolis Fire Department, conducted drill work at the first meeting, and the coöperation of the Minneapolis Fire Department has helped materially toward the success of each of the school sessions. Harvey Walker, then Acting Executive Secretary of the League of Minnesota Municipalities, arranged the first school, and his successor, Ambrose Fuller, served as director of the fire schools until 1938. The U. S. Bureau of Mines, the National Board of Fire Underwriters, Western Actuarial Bureau and Fire Underwriters Inspection Bureau were among other organizations lending support and sponsorship to the school.

The work of the Northwest Fire School has been supplemented in recent years by the state fire marshal's office, which has arranged each year a series of regional schools, many of which were sponsored by regional firemen's associations. In 1938 1-day regional schools were held in 9 cities with a total attendance of 1687 firemen. The 11th Annual Northwest Fire School brought out 182 men from 69 cities. In addition to the 3-day short course, a 5-day school was also held for instructors. The latter course was devoted entirely to teaching methods and was conducted by N. B. Giles of the United States Department of Education. Twenty-six fire department instructors completed this course.

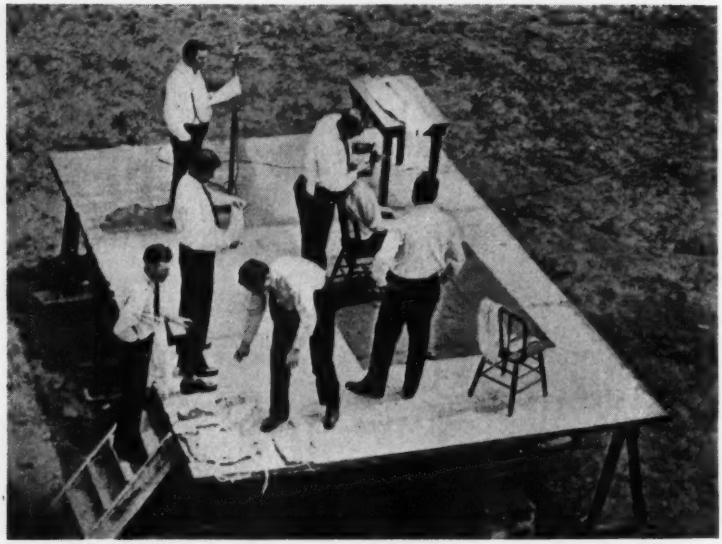
Mississippi. While a state-wide program of firemen's training has never been carried out on as comprehensive a basis as in some other states, there has been considerable interest in training in Mississippi. In 1928 a short course was held at the fire department in Jackson and short courses or regional schools have been held in various cities from time to time. In 1938 a regional fire school was held at Oxford, Miss., with an attendance of about 40. In 1932 the Vocational Education Division of the Mississippi State Department of Education and the Mississippi State Rating Bureau prepared a firemen's manual entitled "The Job of Fire Fighting," which has been widely used in the state.

Missouri. Firemen's training in Missouri has been carried on not by a single annual short course, but by regional schools. At one time or another short courses have been held in various parts of the state, but two schools have become annual affairs. The oldest of these is the Southeast Missouri Fire School, the 9th annual session of which was held August 10-11, 1938, at Chaffee, with an attendance of 99 firemen from 26 cities. The Missouri Central Fire School has been held each year since 1933 at the University of Missouri, Columbia. The 6th annual session, May 25, 1938, was attended by 157 firemen from 130 cities. This school is sponsored by the Columbia Fire Department and the Department of Industrial Education of the University of Missouri. Since 1935 a periodic bulletin dealing with matters of interest in firemen's training work has been issued from this school to all fire departments in the state. The Columbia school has come to be an advanced school, principally for fire department instructors.

During 1937 the various county associations of firemen began holding regional fire schools. During 1938 three county associations held 10 such meetings; 649 firemen from 81 different towns attended them. Since 1928 Captain Hugh C. Ousley of the Missouri Inspection Bureau has been available to cities as a fire department instructor. He has assisted at all of the regional and most of the county schools. In addition, during 1938 he made visits to over 100 cities, giving instruction to an estimated number of 500 firemen.

Montana. In 1931, 1932, and 1933 the Montana State Firemen's Association and the Montana State College sponsored an annual short course. This was given up due to friction in the firemen's association, presumably due to a conflict of interest between members of volunteer and paid departments. The State Department of Vocational Education held one course for instructors at Missoula in 1932. At present the state is without a training program. A few chiefs and firemen who are particularly interested have been participating in the annual school of the Washington State Firemen's Association.

Nebraska. February 7-9, 1938, the Grand Island Fire Department sponsored a fire school with the coöperation of the state fire marshal's office. The meeting was conducted



Courtesy R. B. Criswell.

Demonstration platform (note microphone) at an Ohio regional school. Shaker Heights Fire Department crew demonstrating first aid.

by J. Burr Taylor and Harry K. Rogers of the Fire Prevention Department of the Western Actuarial Bureau. Three hundred and eighty firemen attended from 98 towns.

As a result of this successful meeting, Fire Marshal Horace M. Davis was elected Director of Fire Schools and a state-wide program embracing four regional schools has been developed for 1939. One-day schools will be held at Norfolk, Alliance, Holdrege and Seward, during the coming February and another three-day school will be held at Grand Island in May, that city being a central point in the state.

Nevada. A state-wide program of firemen's training in Nevada is the outgrowth of coöperation of the State Department of Education, Chauncey W. Smith, Superintendent of Public Instruction, and Donald C. Cameron, State Supervisor of Trade and Industrial Education, with the Reno Fire Department. An instructor training course was first held in the fire department at Reno in May, 1934. In 1937 the Nevada State Board for Vocational Education employed Captain Jay D. Hall, on leave from the Los Angeles Fire Department, to serve as an itinerant instructor. He gave one-week courses at thirteen cities. The success of this program led to the employment of Captain G. E. Anderson, retired from the Los Angeles Fire Department, as an itinerant instructor full time to do fire department training work. His schedule calls for two weeks of training in firemanship in each of the 23 fire departments of the state. During 1938 he gave instruction to over 408 volunteers.

New Hampshire. A conference for fire department instructors was held in 1935 at Concord with the coöperation of the Concord Fire Department, State Department of Vocational Education, and the U. S. Office of Education, but as yet no state-wide program of training has been undertaken.

New Jersey. The Vocational Division of the State Department of Public Instruction under John A. McCarthy, Supervisor of Trade and Industrial Education, and John M.

Fecher, Supervisor of Foreman Training, has given assistance to fire departments in the state in connection with their training programs since 1932. They have for the most part left the initiative to the local volunteer and paid fire companies. The department, however, has held at least one instructor-training conference for fire department officers in a county area each year and also in several larger cities, including Newark and Elizabeth. In Morris County in 1932 an instructor's course was taken by 16 officers and men from volunteer fire departments in the county. These officers and men formed the Morris County Fire School Association and have continued periodic training sessions. Instructors, members of the association, have been available to all the fire departments in the county. They give instruction on seven subdivisions of volunteer fire department work, each of which has been developed as a part of the instructor-training courses. These topics cover (1) team work, (2) fire prevention, (3) apparatus and equipment, (4) ventilation, (5) fire department hydraulics, (6) first aid, (7) fire department organization and procedures. Another development is the organization of the South Jersey Fire School of Instruction by the firemen's associations of Camden, Cape May, Cumberland, Gloucester and Salem Counties. Schools have been held in some of these counties. In Gloucester County, for example, an instructors' school was held during the season 1933-1934, 43 men graduating. Twenty-seven instructors from this course are now being used in five district schools. These are held at points in the county so located that firemen average only four miles travel to each school The 1937-1938 course consisted of 30 lessons prepared by the Fire School Committee of the Gloucester County Firemen's Association and 150 men took the course.

New Mexico. The New Mexico State Firemen's Association organized a fire college in connection with their annual convention in 1930 and have held three-day short courses each year since. Harry K. Rogers of the Western Actuarial Bureau has served as director of the drill work in these schools and responsibility for instruction has been also assumed by Clarence Goldsmith, Assistant Chief Engineer, National Board of Fire Underwriters, Chicago, and L. A. Barley, Chief Engineer, Mountain States Inspection Bureau, Denver. At the 9th Annual Fire College held at Carlsbad May 16-18, 1938, 123 firemen attended from 26 fire departments. Theodore A. Rosenwald, Secretary of the New Mexico State Firemen's Association, reports that plans for a more comprehensive state-wide program will be considered at a meeting of fire chiefs with the program committee of the association in February, 1939.

New York. During 1938 a Bureau of Public Service Training was established as a branch of the University of the State of New York to take advantage of the vocational funds available for public service training programs. Albert H. Hall of Albany is chief of this bureau. Mr. Hall was formerly Director-Consultant of the Municipal Training Institute of New York State, a project formerly administered by the New York State Conference of Mayors and which the new Bureau of Public Service Training supersedes.

The Training Institute and the Mayors Conference had established in 1929 a system of zone schools for firemen's training throughout New York State. This training was carried on by a joint committee of the New York Conference of Mayors and the New York State Association of Fire Chiefs. An annual state Institute for Fire Chiefs has been held each year in connection with the annual meeting of the New York State Association of Fire Chiefs and the annual meeting of the Mayors Conference. The 1938 meeting was held at Elmira June 8-10, and was attended by 125 fire chiefs.

Training has been carried on at approximately 20 zone schools. In 1930 and 1931 and again in 1936 a school for zone school instructors was held at the Albany Fire Department. The 1931 conference developed a standard curriculum for the zone schools, consisting of twelve lectures and an examination. This covered 24 class hours of instruction. In addition training was required to be given in 20 standard evolutions. In 1938 zone schools were held at Buafflo, Rochester, Syracuse, Utica, Watertown, Ogdensburg, Troy, Albany, Poughkeepsie, Ithaca, Gloversville, Glens Falls, Binghamton and Schenectady. Cities in the New York Metropolitan Area outside of New York City proper were provided with a choice of four zone schools at New Rochelle, Yonkers, White Plains and Mount Vernon. In Columbia

County two zone schools were held, one at Chatham and one at Greenport. Attendance at the zone schools during 1938 was 1819.

Nassau County, New York, is served by a large number of volunteer fire departments. In 1933 the Nassau County Board for Vocational Education was induced to sponsor a firemen's training program for the county. Currently the Nassau County program embraces the services of Chief Arthur F. Bell, former instructor of the fire department in Jersey City, N. J., and John J. Sweeney, as itinerant instructors. They yearly reach nearly all of the 54 villages in Nassau County. A special car is provided for the instructors with tools and appliances for drill work, and flood lighting equipment for night instruction.

Each department is scheduled for seven periods of instruction each year, three outdoor drill sessions and four indoor class sessions. In 1938, 10,856 firemen in the county attended these classes. About 800 men took the final examination for the course and about 700 were awarded certificates by the Bureau of Public Service Training.

North Carolina. Sherwood Brockwell, State Fire Marshal of North Carolina, was one of the earliest advocates of firemen's training programs. In 1929 he got the North Carolina State Firemen's Association to establish an annual fire college and drill school which has been held each year since. Sessions of the school have been held at principal cities throughout the state, each of which has been required to provide a drill tower and other drill facilities. This has had the result of giving all the principal cities satisfactory drill facilities. The 1938 sessions were held at Asheville May 17-19, with 324 men present from a total of 76 fire departments. Two hundred and seventy-three firemen attended all sessions of the fire college and participated in or observed the drill school work in the pump operators class and were awarded fire college certificates. Of this 273, 94 participated in all drill sessions and were awarded drill school certificates. At the 1938 college diplomas were also awarded to 38 firemen who had attended all sessions and drills for four full years.

Chief Brockwell has also served for many years as director of the Maryland Fire College and Drill School and conducted for several years the annual instructors' course at Richmond, Va. He was director of the South Carolina Fire College in 1935 and 1936 and has participated in state training programs in Georgia, Florida and other states.

North Dakota. In 1935 the North Dakota Firemen's Association secured an appropriation from the state legislature under which they established a program of 4 two-day regional fire schools. The assistance of the Western Actuarial Bureau of Chicago and the Fire Underwriters Inspection Bureau of Minneapolis was secured. C. B. Craven of Carrington, N. D., served as supervisor of these schools during 1935 and 1936. Henry E. Jurgenson, Drillmaster of the Minneapolis Fire Department, had charge of the drill evolutions. The program has been continued in 1937 and 1938 under the direction of L. R. Nostal of Rugby and Chief J. J. O'Leary of Minot. In 1938 five one-day regional schools at Valley City, Devils Lake, Kenmare, Dickinson and Mandan, were attended by a total of 941 firemen.

Ohio. In 1930, at the urging of the Fire Chiefs Association of Ohio and the Ohio Inspection Bureau, the first annual short course was established at Ohio State University in Columbus. Dr. Harvey E. Walker of the Department of Political Science served as the first director of the Ohio Fire School. (He had been director of the 1st Northwest Fire School in Minnesota.) Representatives from about 40 fire departments took part in the annual schools, which were held each year thereafter up to and including 1937. In 1932 Professor K. W. Stinson of the Mechanical Engineering Department of the College of Engineering became director. Drilimasters from many of the larger fire departments in Ohio served as instructors at the annual school. A great deal of the instruction was handled by Marshal H. C. Williams, drillmaster of the Cincinnati Fire Department and R. B. Criswell, Engineer of the Ohio Inspection Bureau. The Columbus Fire Department generally furnished needed apparatus and crews for demonstration purposes, and the expense of the schools was shared by the Fire Chiefs Association of Ohio and the Ohio Inspection Bureau.

Since 1933 this annual school in Ohio has been supplemented by regional fire schools held for the most part in connection with regional firemen's association meetings. R. B.

Criswell also kept up continuous contacts with fire departments, large and small, throughout the state, holding many meetings for instruction purposes, giving demonstrations and otherwise helping to promoted interest in the training program. How important was Mr. Criswell's influence as the "spark plug"of the Ohio training program was shown when the program for the most part collapsed when he left Ohio to assume the direction of firemen's training in Maryland in 1937. Recently the Ohio State Fire Fighters Association has approached the State Department of Vocational Education with the idea of getting a training program set up on a basis similar to that in other states.

Oklahoma. Oklahoma is a state where almost every type of firemen's training program has been tried out over the period of the last fifteen years. In 1926 a short course was held in connection with the convention of the Oklahoma State Firemen's Association with drillmasters from the fire departments at Cincinnati and Oklahoma City and the coöperation of Clarence Goldsmith, Assistant Chief Engineer of the National Board of Fire Underwriters and H. J. Clark, Chief Engineer of the Oklahoma Inspection Bureau. The Oklahoma Inspection Bureau also employed during 1931 a fire department officer from the Oklahoma City Fire Department and later another from the Tulsa Fire Department to give instruction on request in various cities of the state. This showed the possibilties of such work by itinerant instructors and later the State Department of Education undertook the work.

The Oklahoma State Firemen's Association held a short course each year until they arranged in 1934 for it to be taken over by Oklahoma A. & M. College, Stillwater. It was held in December, 1938, preceded by a one-week course for training of instructors. A statewide fire service training program, in general charge of W. Fred Heisler, is being carried on jointly by the State Department of Education and Oklahoma A. & M. College in coöperation with the Oklahoma State Firemen's Association, the Oklahoma Fire Chiefs Club, the Oklahoma Inspection Bureau, and the Oklahoma Municipal League. An introductory course in fire service training has been developed containing ten 1-hour units so arranged that it can ordinarily be given in three or four meetings. Captain Everett Hudiburg, of the Stillwater Fire Department, has been employed as an itinerant instructor. During 1938 three-day schools have been held in 28 cities. Certificates showing completion of the introductory course were granted to 273 firemen. These schools were under the direction of Captain Hudiburg and fire department drillmasters developed by the training program for drillmasters in the state. In addition to the introductory course schools and the annual short course and drillmasters' schools, two regional fire schools were held and participated in by firemen from 14 cities. The training of drillmasters has also made it possible to set up local training schools. Such schools were held in 12 local fire departments under the direction of their respective drillmasters, with 424 men enrolled.

Oklahoma A. & M. College at Stillwater in 1937 announced a 2-year course offered by its School of Technical Training of its Division of Engineering. This course is designed to train men for positions in fire departments and is in charge of Professor R. J. Douglas, former chief of the fire department at Morefield, W. Va. A corollary to the development of this course for firemen is the organization of an informative course in fire protection engineering which all engineering students at Oklahoma A. & M. are required to take.

Oregon. Since 1930 an annual short course has been conducted by the Oregon Fire Chiefs Association at its annual meeting. Early sessions of the school were held at Corvallis with the coöperation of the Oregon State College, and the state fire marshal's office has assisted at all of the schools. In 1938 over 200 fire chiefs and firemen participated in the annual school held at Pendleton September 12-14.

The State Department of Vocational Education under Mr. O. D. Adams has assisted a number of the schools. In 1936 a fire instructors' training conference was held at Salem sponsored by the State Board for Vocational Education, the state fire marshal, and the League of Oregon Cities. In 1938 Chief L. L. Mohr of The Dalles conducted an experimental 2-day regional school for volunteer fire departments at Milton.

Fireman leader-training conference, Sunbury Volunteer Fire Department, conducted by Department of Industrial Education, Pennsylvania State College, and the State Department of Public Instruction.

Five regional firemen's associations have held monthly meetings at which fire training programs have been conducted. The Portland Fire Department has a Fire College under the direction of Battalion Chief Edward L. Boatright. Drill manuals developed by the college were furnished in 1938 to all fire departments of the state by the State Fire Marshal.

Pennsylvania. In 1933 and for a number of years a regional short course was held annually at the Pennsylvania State Teachers' College at California under the auspices of the Pennsylvania Southwestern Fire Chiefs' Association. Also a number of volunteer fire departments in Pennsylvania have undertaken firemen's training classes. Most of these have been assisted by the State Department of Public Instruction. W. E. Brunton, Advisor in Industrial Education, has until 1938 directed these classes. During 1938, 551 firemen attended 17 such classes.

The year 1938 also marked the organization by the State of Pennsylvania of a State Public Service Institute under the State Department of Public Instruction and the State Board of Vocational Education. Rollin B. Posey of Harrisburg was appointed Principal. He is now responsible for the firemen's training program. Mr. Posey reports that by the first of 1939 he expects to have firemen's training classes in 15 or 20 centers in which classes will be conducted on the basis of one night a week for 15 weeks.

Rhode Island. Through the good offices of R. L. Wales, Dean of Engineering, a conference on firemen's training was held in January, 1938, at the Rhode Island State College in Kingston. More than 100 fire department officials and firemen attended. As a result of the interest displayed by this meeting, the development of a state-wide program of training was left in the hands of a committee headed by Mr. Willard B. Hall of the Woonasquatucket Valley Volunteer Firemen's League.

South Carolina. Short courses were held at Columbia in 1935 and 1936 under the auspices of the South Carolina State Firemen's Association. At present there is no statewide program in South Carolina.

South Dakota. The 1st South Dakota Fire School held at Madison was an outgrowth of the South Dakota Annual Volunteer Firemen's Tournament. The Volunteer Firemen's Association, coöperating with the South Dakota Firemen's Association and the South Dakota Fire Chiefs Association, arranged for the state fire marshal's office to undertake the direction of the school. A short course has been held each year since 1930. The Western

Actuarial Bureau, the Fire Underwriters Inspection Bureau of Minneapolis, and the Fire Insurance Patrol of St. Paul, Minnesota, have all coöperated in the school program. The 9th Annual Fire School was held in Mobridge the week of May 30, 1938, with an attendance of some 700 firemen.

Tennessee. Tennessee has been slower than some of its neighboring states in getting a firemen's training program under way. This is presumably due to the fact that a fire department instructors' conference sponsored by the Western Actuarial Bureau is held in Memphis each year. This presents an annual opportunity for firemen interested in firemen's training to take part in an annual short course. In 1935, two regional short courses were held and another in 1936. Since 1927 the Tennessee Inspection Bureau has maintained a fire department instructor, Chief W. D. Rogers. His services have been available to fire departments in the state on request and each year he has given training to about 100 fire departments.

On July 1, 1938, the State Board for Vocational Education undertook a training program by appointing B. L. Englert, formerly a member of the fire department at Jackson, to a position as fire department instructor. The new program has the support of the Tennessee State Firemen's Association. During the last four months of 1938 Mr. Englert conducted training schools in 12 towns. In most of these five 2-hour weekly class sessions were held, with a total attendance of 133. He also assisted Drillmaster E. L. Mitchell of the Knoxville Fire Department put on a school 6 hours a day for 12 days in that department for 122 men.

Texas. Texas has one of the most comprehensive and thoroughgoing training programs of any state. In 1929 the Volunteer Firemen's Association in Texas requested the Engineering School of Texas A. & M. College at College Station to establish a short course for firemen. In setting up this course the school had the active coöperation of the Texas Inspection Bureau, the Texas Fire Insurance Department, and the State Fire Marshal. Professor H. R. Brayton of the Department of Chemistry and Chemical Engineering assumed the duties of director of the school. The first short course held at College Station in the summer of 1930 was a 2-day course. In 1931 the sessions were increased to three days and in 1932 to four days. In 1935 the program had stretched out to five days. It was found necessary after the first few years to give not one course at each of these short course sessions but two — one a general course and the other an advanced course. By 1937 it was found necessary to arrange a special course for instructors to be held the week preceding the short course. In 1938 the school curriculum was added to by a special course for city fire marshals, in the organization of which the state fire marshal's office played an important part.

The annual short course embraces eight separate units of instruction, each of these in charge of an instructor. The group is broken up into eight sections, which are turned over to the instructors in charge of each unit on a predetermined schedule covering an entire period from Monday to Friday. The general course covers the elements of such subjects as hose lines, ladders, salvage, tools, pumps, fire fighting principles, fire department safety, fire prevention and hazards.

Those taking the advanced course are handled in a similar manner, being divided into eight sections which discuss such subjects as hose loads and layouts, fire streams and tests, water systems and supply, pump operations, attack and control of fires, inspection work and reports, fire prevention and hazards, and instructional training.

At the 9th annual session of the Texas Firemen's Training School at College Station, July 18-22, 1938, 540 men, representing 245 Texas cities, were in attendance. These men must not only take the course, but must pass a written examination, which is one evidence to the city officials who have sent them that the time is put in at the school in a profitable manner. In 1937 motion pictures were taken of the work at the school which have been displayed in various cities around the state, showing further the intensive and serious character of the firemen's training work at the short course.

The Training School operates under an advisory committee of seven members. Three of these are the president, dean and head of the Department of Chemistry and Chemical

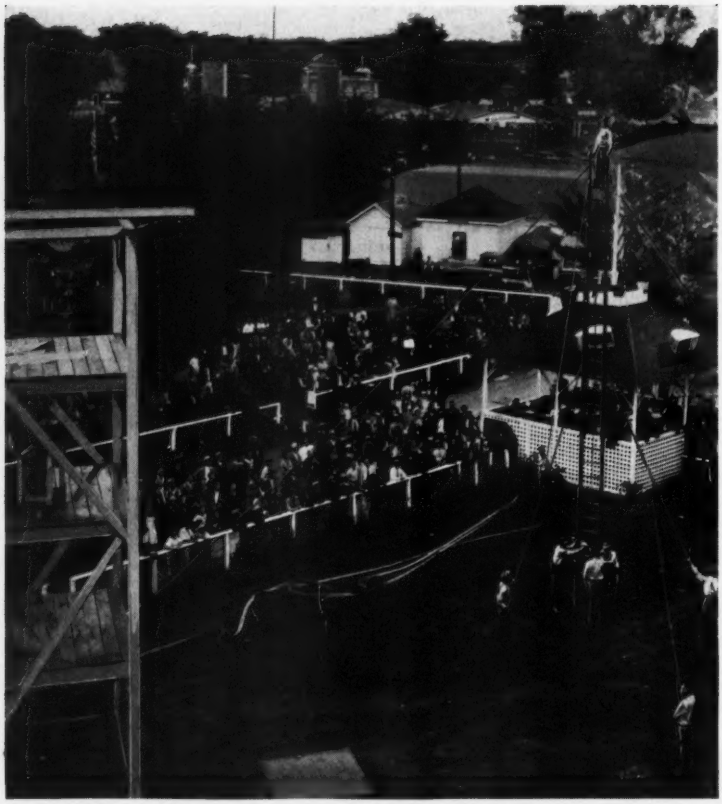


Photo courtesy W. C. Hodges.

Exhibition drills have been employed to promote public support for firemen's training. Each night during the Kansas Free Fair at Topeka, 15,000 people watched firemen work on a specially built drill tower.

Engineering of the college. The other four are representatives of the State Firemen's Association: Olin Culberson, secretary, and W. P. Walker, corresponding secretary, Charles R. Ramsey, fireman and mayor of San Marcos, and Battalion Chief J. D. O'Brien, drillmaster, Fort Worth Fire Department.

Professor E. L. Williams, head of the Department of Industrial Education, A. & M. College, which is affiliated with the State Vocation Education program, has also assisted fire departments of the larger cities of the state in organizing special firemen's training classes. The activities of his department have been largely confined to cities which are in a position to organize their own training program.

In December, 1933, the work of the annual short course in Texas was supplemented by the employment of Chief G. F. Williams of Winters. His schedule provides that he shall contact and give instruction to every fire department in the state at least one day during each year. In addition, Chief Williams assists the local fire marshal and school officials in their fire prevention and inspection activities and confers with the city officials regarding any problems relating to increasing the efficiency of their municipal fire fighting and life

saving activities. Chief Williams has a special training school car for this purpose and in a typical year will contact some 200 fire departments and 5000 or more firemen.

In addition to the annual school and contacts by the field instructor, the training school mails instructional drill sheets prepared at the annual drillmasters' conferences to all fire departments in the state. These mailings go out four times a year. The school maintains constant contact with the fire departments in the state by correspondence.

Utah. In 1934 a firemen's training program was tried out in the fire departments of 10 cities near Salt Lake City. The program was one developed by the Educational Committee of the state firemen's association in coöperation with the State Department of Vocational Education. Battalion Chief J. K. Piercey of Salt Lake City was made available by the Salt Lake City Fire Department to promote the firemen's training work. By 1935 a program had been laid out which attempted to make at least one training course available to every volunteer fire department in the state. By and large, the plan was to visit a center and determine the local needs and to organize a training program around these needs. Classes consisted of anywhere from 4 to 30 members and instruction of anywhere from 2 to 18 hours was given. At first it was found that the most urgent needs were training in the operation of engines, handling hose, and the making of proper inspections. Later classes took up matters of salvaging operations, ventilation, and fire department organization. Several hundred feet of motion picture film has been produced. Local departments have been encouraged to set up their own educational committees, the Educational Committee of the Utah State Firemen's Association helping with data and instruction facilities. In 1938, 30 fire departments held sessions with attendance of approximately 500 men.

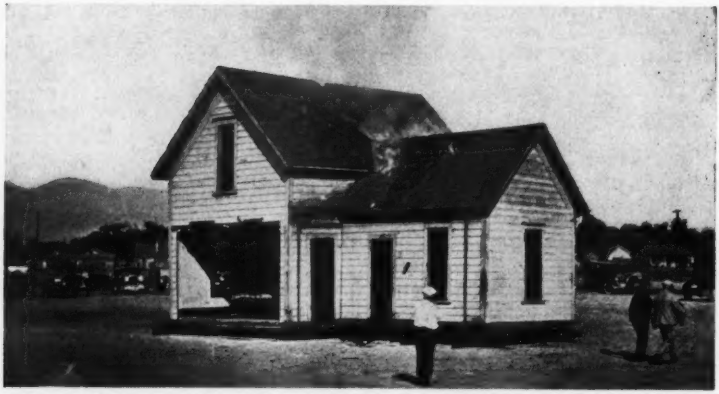
Vermont. The Vermont State Firemen's Association held two schools in connection with their annual conventions in 1933 at Rutland and in 1934 at Montpelier. Chief Alfred H. Koltonski of Rutland and Norman D'Arthenay, drillmaster of the Montpelier Fire Department, have assisted at several one-day regional schools. Drillmasters from Massachusetts cities gave an instructors' course for the Rutland Fire Department and have assisted at some of the schools. There is no state-wide program in Vermont at present, but the Vocational division of the State Department of Education is studying its possibilities.

Virginia. In-service training for firemen has been conducted since 1933 by the League of Virginia Municipalities with the coöperation of the State Division of Trade and Industrial Education, the Virginia State Firemen's Assocation, and the State Fire Chiefs Association. Harold I. Baumes, Director of Personnel Training, has been in charge of the program. Sherwood Brockwell, State Fire Marshal of North Carolina, conducted instructors' conferences at Richmond in 1933 and each year following through 1936. These conferences developed a staff of instructors who have been carrying on a firemen's program in the rest of the state through schools located at 24 zone centers. The instructors have organized a Fire Department Instructors' Institute which has held periodical meetings.

For the last two years the program has been allowed to coast somewhat and plans are under way to reorganize it. During 1938 zone schools were held at only 10 points, with a total attendance of 275 firemen.

Washington. In 1931 the first state short course was held in connection with the annual meeting of the Washington State Firemen's Association at Port Angeles. The program was arranged and carried out principally under the direction of Battalion Chief Robert B. Rogers of Seattle and Battalion Chief Edward L. Boatright of Portland. The latter is now Director of the Portland Fire College.

Considerable interest was aroused by this short course program, which was repeated at subsequent annual meetings of the association. In 1934 Chief Rogers was employed for some months by the state fire marshal's office in a program whereby he conducted eight regional fire schools and also drills and schools in 29 cities. At the 6th Fire School at Tacoma an impressive night show was staged for the benefit of the local citizens and to advertise the fire school work. In 1936 Captain Joe Cook, drillmaster from the Seattle Fire Department, served as an itinerant instructor, contacting all of the fire departments in



Pictures courtesy Robert B. Rogers.

The small dwelling set on fire for a fire fighting demonstration at the annual fire school of the Washington State Firemen's Association. One room wall is cut away for demonstrating salvaging operations. After entire roof and attic were involved (about 13 minutes), fire company 2½ blocks away was called. Men responded, laid two 1½-in. lines from 350 ft. of 2½-in. hose and, using one small line inside and one outside, controlled fire in 3½ minutes.

the state at least once in a program sponsored by the state firemen's association and the state fire marshal's office. During 1937 the fire school program, in coöperation with the Washington State Association of Fire Chiefs, was extended to include 15 regional Sunday meetings. W. A. Groce, Secretary of the Washington State Association of Fire Chiefs, is Chairman of the Fire School Committee of the association. Attendance at the 1938 fire school held at Wenatchee, June 16-18, 1938, included 533 firemen from 107 fire departments.

West Virginia. In 1931 the Extension Division of West Virginia University sponsored the first annual fire school at Morgantown, with the coöperation of Fire Marshal C. O. Stahlman, and the West Virginia Inspection Bureau. This annual fire school has been very popular and has been held each year since. Fred Watkins, the present Fire Mar-

shal of West Virginia, has done much to promote the school program. Lewis V. Carpenter was director of the first school and D. L. McElroy succeeded him. In 1938, G. R. Spindler became director of the Fire Service Extension Schools. Chief Harry K. Rogers of the Western Actuarial Bureau has generally conducted the drill work. The 8th annual fire school in Morgantown June 25-27, 1938, enrolled 234 men from 56 cities.

During the period 1933 to 1937 the state school was supplemented by five or six two-day regional schools sponsored by the Extension Division. In 1936 and 1937 the Extension Division studied the possibilities of a more comprehensive short course which might be given to an individual volunteer or paid fire department. R. C. Criswell of the Ohio and West Virginia Inspection Bureaus, and later in charge of the Maryland program, developed the first outline of this course.

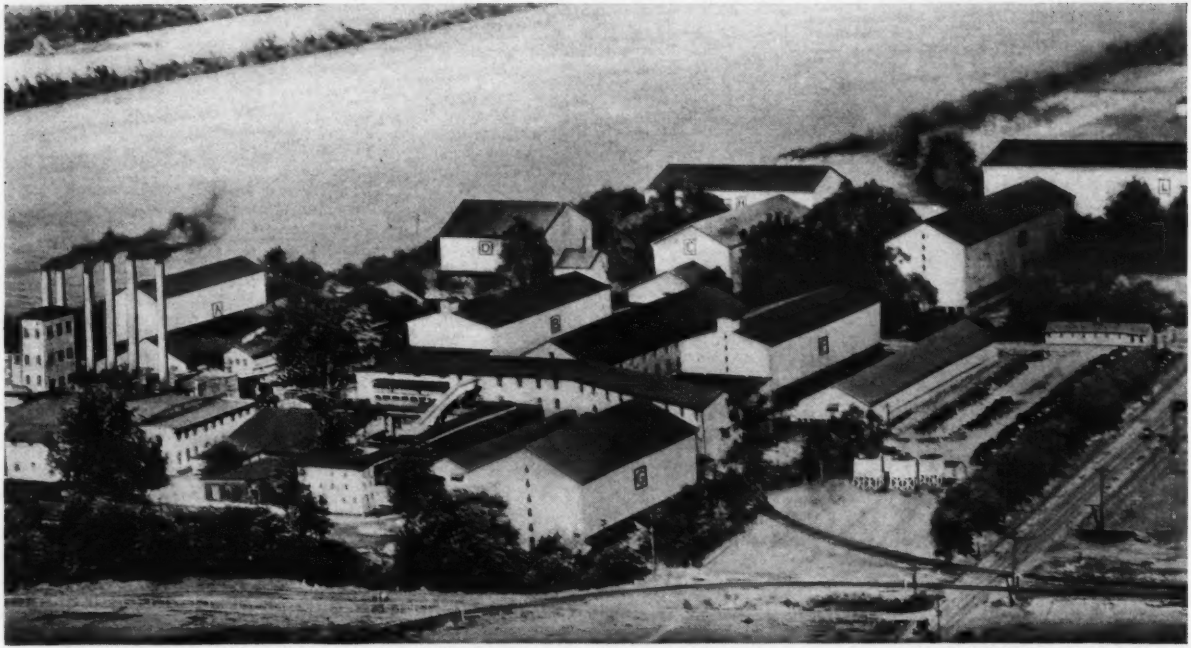
During 1938 this course as finally adopted is being given in night classes conducted at 20 points in the state with a total of 440 firemen enrolled. The classes are conducted by instructors who have been developed from local fire departments as a result of attendance of the men at the state or regional schools. The classes meet once a week for a period of thirty weeks, a two-hour meeting each week. The course includes 24 indoor meetings and six drill meetings and embraces a total of about 60 hours of instruction. The emphasis of this course is not on basic or elementary work. It starts off with a discussion of the broad subject of community fire defense, a study of the local water distribution system, fire apparatus, pumps and the like, and covers fire prevention education and inspection work before getting into the elementary drill work at all.

Wisconsin. In 1929 the first annual short course in firemanship was held at the University of Wisconsin at Madison, sponsored by the University Extension Division. The annual short course was held each year from 1929 to 1933, and then was omitted for four years due to lack of funds. A short course was held at the University, August 23-25, 1938, with an attendance of 318 firemen from 81 departments. The Fire Insurance Rating Bureau of Wisconsin has made the services of a fire department instructor in the person of Engineer V. C. Rutter available to numerous fire departments in the state on request.

In September, 1938, the Wisconsin Schools of Vocational and Adult Education set up a Fire Service Division, with James W. Just as Director. Chief Just had been in firemen's training work since 1926, with the Michigan Inspection Bureau, the Illinois Inspection Bureau and the Western Actuarial Bureau. His experience covered participation in state and regional schools in about 20 states. Chief Just's current program is reaching 28 fire departments and approximately 550 firemen. These are being given a two-hours period of class instruction every two weeks and covering a total of 40 hours. Chief Just's program is set up under the direction of an advisory committee of the State Fire Chiefs Association, the Wisconsin Paid Firemen's Association, the International Association of Fire Fighters, the Wisconsin Industrial Commission and the volunteer firemen's associations of the state. During 1939 it is proposed to develop qualified instructors from among the fire departments of the state as a means of extending training to fire departments as rapidly as possible.

Wyoming. Since 1933 the Wyoming State Firemen's Association has devoted a part of the four-day sessions of its annual convention and tournament to a short course for firemen. The annual school was held at Cheyenne June 23-25, 1938, with an attendance of approximately 150. A comprehensive firemen's training program has been adopted to be carried out by the Educational Committee of the State Firemen's Association. Chief W. H. Pauley of Basin is chairman of this committee. Associated with him are five other fire chiefs, and L. A. Barley of Denver, Chief Engineer of the Mountain States Inspection Bureau, and F. M. Treat of Cheyenne, State Director for Vocational Education.

The State Department of Vocational Education secured Captain James Owens, on leave from the Los Angeles Fire Department, to give an introductory course of firemen's training in the following cities during 1938: Evanston, Rock Springs, Superior, Laramie, Riverton, Basin, New Castle, Casper, Cody and Jackson. Captain Owens put in about a week's work with each of the fire departments in these communities. The program will probably be continued on a similar basis during 1939.



The main plant and warehouse section of the Glenmore Distillery near Owensboro, Ky., before the $1,800,000 fire destroyed six of the buildings and over 31,000 barrels of whiskey on November 12, 1938. The construction of the buildings and their nearness to each other, together with an inadequate water supply and inadequate drainage system to carry off the burning whiskey, were factors responsible for the large loss.

Whiskey Distillery Fire, Owensboro, Ky.

Report by Kentucky Actuarial Bureau,
(Member N.F.P.A.)

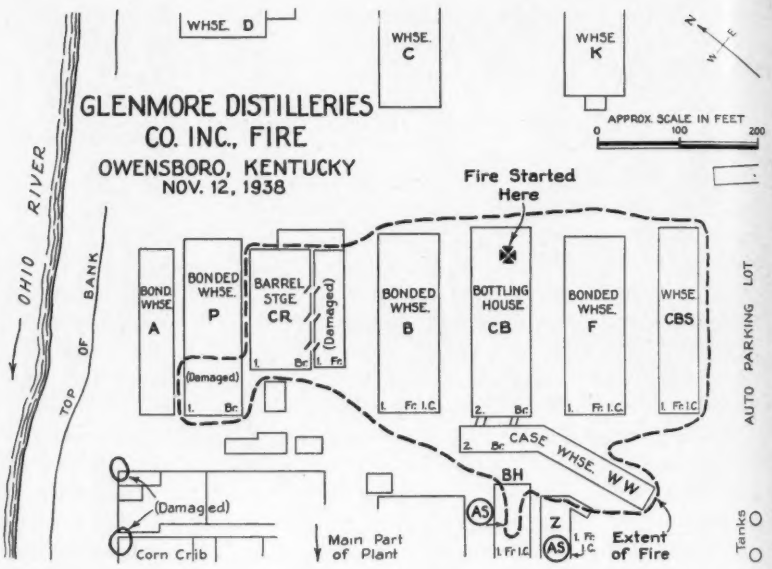
The largest loss fire at any one plant during the year 1938 occurred just outside the city limits of Owensboro, Kentucky, on Saturday evening, November 12, 1938, at the Glenmore Distilleries Co., Inc. The fire started in the bottling house several hours after it had been closed for the day, and spread rapidly. Before it was brought under control the following day, it had destroyed six buildings, and damaged five others, resulting in a loss estimated at $1,800,000, the largest part of which was to whiskey. More than 31,000 barrels of whiskey of various ages, nearly 10,000 cases of three gallons each, and 24,000 gallons of whiskey in tanks were destroyed.

The group of buildings involved consisted of a large 2-story brick bottling house CB and a 2-story brick case storage house WW with unprotected floor openings; two frame iron-clad bonded warehouses B and F of open rack construction, each of 16,000 barrels capacity; a frame iron-clad tax-paid warehouse CBS of 1400 barrels capacity; an ordinary brick barrel storage house CR, adjoining and communicating with which were a cistern room and vacant section of fire-resistive construction; a brick bonded warehouse P used as a hot house and regauging room; a frame iron-clad bottling house BH; and a frame iron-clad case storage warehouse Z. All buildings had composition roof coverings, and the brick buildings had high peaked roofs with large overhanging eaves.

None of the buildings destroyed were sprinklered. Sprinklers in the sprinklered buildings which were damaged were not a factor, as the systems were shut off to conserve water, and the fire that entered these buildings was extinguished with hose streams.

Story of the Fire.

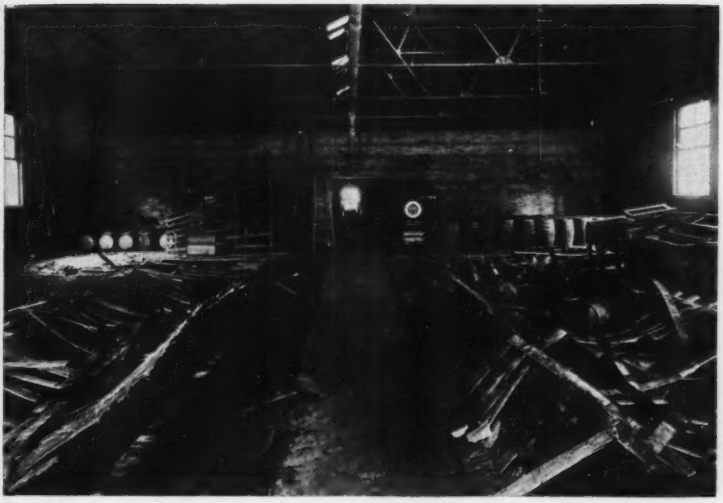
The plant had been operating as usual in the morning, and about 2:00 P.M. bottling house CB was visited and locked by the plant superintendent. About 5:45 P.M. he passed the east end of this bottling house, but noticed nothing unusual. When he arrived at the office shortly thereafter, the annunciator board of the plant speaker system indicated something was wrong in the east end of the bottling house, and about this same time the night watchman coming on duty thought he saw fire there. A call was immediately sent to the Owensboro fire department, the alarm being received at 6:15 P.M. The department responded with a 1000-gallon pumper, accompanied by the chief. The chief immediately sent for his other pumper, from which he removed the



hose and sent it back in order not to leave the city without protection. Three lines were laid from the pumper, which was stationed at the hydrant in the automobile parking lot.

The chief states that by this time a considerable portion of the first floor of the bottling house was on fire, and when he attempted to enter by breaking open a large door, an explosion occurred that blew out part of the wall, injuring a fireman and severing a hose line. Windows on both sides of the building were then opened and hose streams directed through them. At one time it appeared that the fire was under control, but then some of the numerous large whiskey tanks exploded and spread the fire. It was evident that the fire could not be confined to this building, and Evansville, Ind., and Madisonville were called to assist at about 8:50 P.M. They responded promptly with a total of three pumpers and 51 men.

The Evansville department maintained two effective streams on the sprinklered buildings west of case goods house WW and stopped the fire at that point. By this time the fire had spread from the bottling house to case goods warehouse WW and to the bonded warehouses B and F. The frame iron-clad walls of these buildings soon burned away, exposing the standing rack structures, loaded with barrels of whiskey. Efforts were then concentrated on wetting down warehouses C and K on the east and on trying to prevent the fire from spreading to the buildings north of warehouse B.



Fischer.

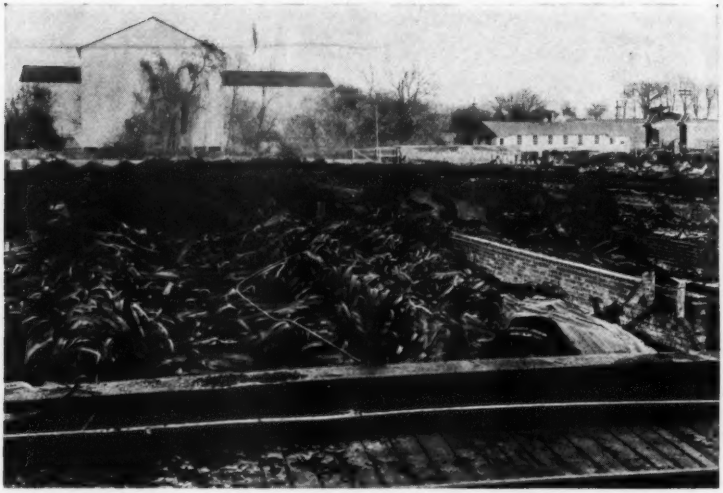
The west end of brick warehouse P, the floor of which was ignited by burning whiskey flowing in through the ventilator openings. The northward advance of the fire was stopped here.

Early the next morning a call to Henderson brought a 750-gallon quad and three men. As the 8-inch water supply main was already delivering its capacity, in order to secure an additional stream this pumper was loaded on a barge at Owensboro landing and towed to a point near the plant. It was kept on the barge and took suction from the river, maintaining a heavy stream which was played on warehouses P and A.

The roof of building CR was ignited by radiated heat passing over and damaging the vacant fire-resistive section nearer the fire. The floor beams under the west end of warehouse P were ignited by burning whiskey flowing in through the ventilator openings. When this was discovered, an air hammer was used to make openings in the brick wall of this building below the floor line through which a stream was directed and the fire extinguished. This prevented further damage to warehouse P and prevented fire from spreading to warehouse A.

During the course of the fire the drainage ditches, which were filled with streams of burning whiskey, became clogged with débris. Help was obtained from a near-by CCC camp to keep the ditches open and to build sand dams across the ditches north of warehouse D and south of warehouse K. These dams prevented the burning whiskey from backing up around the warehouses.

Soon after fire fighting operations started, the water pressure at the Owensboro pumping station was raised to 105 pounds and maintained during



Fischer.

Nothing remains of whiskey warehouses F and CBS, except the barrel hoops.

the fire. The supply to the distillery, however, was seriously limited by the long 8- and 6-inch dead-ended main extending from the pumping station discharge line to the distillery property.

During the early evening a brisk wind from the southwest blew the heat and flames away from the main plant. However, during the night the wind shifted and increased, and by morning a strong wind was blowing from the north.

The cause of the fire has not been determined. The loss of approximately $1,800,000 was mostly to whiskey in barrels, cases, and tanks.

Conclusions.

Had the whiskey tanks in the bottling house been properly vented, there would have been no explosion in these tanks, and the fire would have been extinguished with a partial loss to the bottling house. Automatic sprinklers in this building would have undoubtedly extinguished the fire. After the fire destroyed the bottling house, the adjacent warehouses were doomed because of their nearness and construction.

An inadequate number of hydrants and insufficient water supply seriously handicapped the fire department. (The plant was rated as unprotected.) Fire communicated to warehouse P because the drainage system was inadequate to carry off the burning whiskey. Also because of inadequate drains, burning whiskey flowed into an underground grain conveyor in the distillery part of the plant to the west of the destroyed warehouses and destroyed a belt on the grain elevator.

It should be made clear that the Owensboro fire department was under no obligation to respond to this fire. Had this fire been inside the city limits, the department's response would have been better and the fire kept from communicating through conveyors to warehouse WW.

The first explosion in the bottling house was probably caused by a backdraft when the firemen opened the door. The chief thought he had the fire under control, when exploding whiskey tanks spread the fire — which accounts for the delay of over two hours before asking for aid from Evansville.

Responsible spectators stated that after the racks had collapsed, there were hundreds of unconsumed barrels in the débris, and as these barrels burned through and collapsed, they heard muffled reports accompanied by leaping flames and showers of sparks from burning staves. Whiskey barrels did not explode as earlier reports of the fire stated.

Lumber Shed Fire, McCloud, California.

Board of Fire Underwriters of the Pacific,
(Member N.F.P.A.)

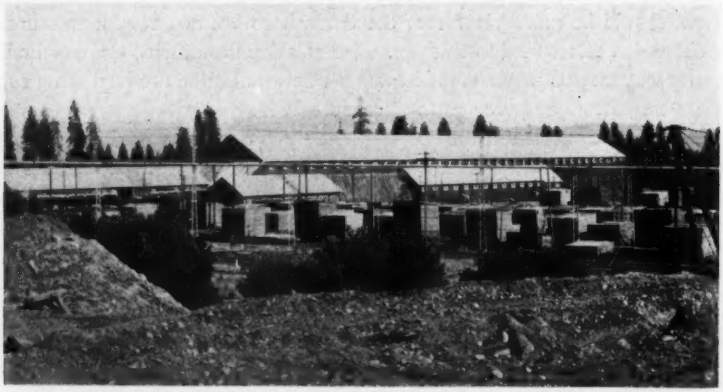
A large sprinklered lumber shed and its contents of over 12,000,000 board feet of rough dry pine lumber were completely destroyed by fire at the McCloud River Lumber Company plant, McCloud, Calif., on November 6, 1938. Sprinklers in exposed buildings were effective in keeping the fire from spreading from the shed, but the sprinklers in the shed were ineffective and the plant volunteer fire department was unable to cope with a fire of this magnitude. The property loss was about $600,000.

Construction and Protection.

This lumber shed was a part of a large lumber manufacturing plant consisting of saw and planing mills, dry kilns, box and door factories, and lumber sheds and yards.

The lumber shed was of ordinary frame construction 900 ft. by 90 ft., one story, 71 to 87 ft. high. It had a capacity of 17,000,000 board feet of lumber, and at the time of the fire contained about 12,250,000 board feet of lumber stored in solid hand piles and crane package piles. The shed was protected by 1728 sprinkler heads on 12 dry pipe systems connected by an 8-in. looped main to three water supplies — with total capacity of about 10,000 g.p.m.

The plant fire department consisted of volunteers of an indefinite number drilling occasionally, but inadequately organized. The fire department equipment consisted of an automobile chassis which had been converted into a hose and chemical truck, which was badly overloaded and of questionable usefulness.



The McCloud lumber shed before the fire which destroyed it and the contents on November 6, 1938.

Story of the Fire.

The fire started in the shed near one end from an undetermined cause. The plant was not in operation at the time.

The first notification of the fire was from a waterflow signal at 8:28 p.m. The watchman, who is considered one of the most competent and observing of the company's men, had passed through the shed about two minutes before this and saw no signs of fire. Although his view was considerably obstructed by lumber piles, the shed was not lighted and any glow should have been apparent. The speed with which the fire started and developed was astonishing. All sprinkler systems having sprinklers in the main roof reported water flowing within ten minutes of the first system to operate. On the first waterflow alarm a resident came out of his house immediately and flame was then issuing from the corner of the shed. The extreme speed of the fire is indicated by the fact that it opened sprinklers 900 feet from the starting point in less than ten minutes, in spite of solid piled lumber and 8 ft. draft stops in the ceiling.

The fire chief and sprinkler maintenance man responded promptly, and soon about 300 men were engaged in fire fighting. Hose lines were taken into the end where the fire started, but because of the intense heat and flying embers this position had to be abandoned almost immediately. Another position about 400 feet toward the other end was taken, but the effect of the three hose lines was negligible, and due to the danger from falling sheets of metal roofing and timbers, this position was also abandoned.

Assistance received from outside communities was of utmost importance in saving the remainder of the plant, as it was estimated that by the time these outside pumpers arrived and were in service the pressure in the mains had dropped to 45 pounds and the direct hydrant hose streams could not reach

The rapid spread of the fire in the lumber shed is shown by this picture, taken from 15 to 30 minutes after it started.

the roof. This loss of pressure was due to the open running sprinkler risers, which could not be shut off because of the intense heat, even though outside control was provided and the valves were 40 to 60 feet from the building. The fire was checked at the far end of the building about midnight, but it was 2:15 A.M. before some of the valves could be reached. The unusually calm night and the operation of sprinklers in adjoining buildings prevented serious exposure losses.

The sprinkler equipment failed to extinguish or hold the fire in check and apparently had but little effect upon the fire in the shed other than to tend to slow the burning, due to many of the piles being wet down before the attack of the fire. When the first two hose lines were taken into the end of the shed where the fire started, the fire chief observed sprinklers operating in the roof, and the electrician stated that the water falling from the sprinkler equipment was at a nearly scalding temperature. The unusual speed with which the fire spread opened a great number of sprinklers and in all probability they received an insufficient amount of water to operate properly.

Conclusions.

The rapidity of spread is not to be accounted for by the occupancy for, although reasonably rapid spread is to be expected in dry lumber, the lumber in this location was largely solid piles without stickers and crane packages extending from wall to wall. Such solid piles are not consumed quickly even in hot fires. In certain small areas, however, the heat had apparently been so intense as to actually melt the sides of concrete footings and gravel on the ground.

It is obvious that such large areas and values should not be subjected to one fire. Experience shows that fires in such a large concentration of combustible material produce conditions which are impossible to control and it is safe to say that but for a favorable combination of circumstances and valuable outside aid, this fire would have involved a much larger portion of the plant and perhaps the entire plant.

It is evident that the fire department personnel and equipment of large isolated manufacturing plants, which often have hazards and structural conditions which would be prohibited even in a city with excellent protection, should be increased to a point commensurate with the hazards and values involved.

Sprinkler Operation.

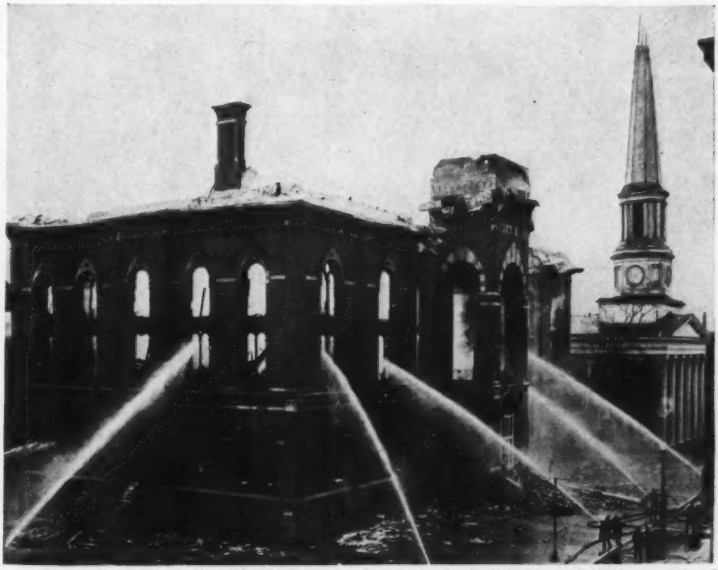
The failure of the sprinkler installation to control this fire indicates the need for better than standard sprinkler protection for a hazard of such large area. While the shed was closed and there was little or no wind, so that there were no unusual draft conditions, it appears likely that in a building of this height the sprinkler heads first opened might have been at a considerable distance from the point of origin of the fire and that the curtain boards provided in the roof trusses were not effective in banking the heat in the area where the fire started. While accelerators or exhausters were provided for all the dry pipe systems, it may have been that the somewhat slower operation of the dry pipe sprinklers as compared with the wet pipe type of system may have been responsible for opening the larger number of heads. The very large water supply available for the plant would presumably have been sufficient to supply all of the 1728 heads in this fire area with water under sufficient pressure for effective extinguishment. However, the entire supply for the twelve dry pipe systems (4, 5, and 6-inch) was through an 8-inch looped yard main, which was obviously inadequate to supply the 10,000 g.p.m. or more necessary to feed all the heads in the fire area.

City Hall Fire, Troy, New York.

By Hugh M. Flick (Member N.F.P.A.),
Supervisor of Public Records, New York State Education Department.

On October 28, 1938, a disastrous fire swept the City Hall of Troy, New York, with a loss of over $150,000 and the life of a fireman. The fire, which apparently started in the drafting room on the third floor, had gained considerable headway before it was discovered shortly after 3:30 a.m. The building, erected in 1875, was three stories high, of typical brick outside and wooden interior construction.

The first alarm brought all the regular fire fighting equipment of the city. It soon became evident that it would be impossible to save the building, and a second alarm called out the reserves. By 4:15 A.M. the fire had developed to such an extent that the firemen were forced to abandon their ladders, and heavy hose streams were brought into play to force large quantities of water into the burning building.



The ruined Troy City Hall after the flames had died down and little remained other than the walls and part of the records. The damaged First Baptist Church is at the right.

The famous old tower with its clock and bell collapsed about one hour and fifteen minutes after the fire started.

A brisk north wind fanned the flames and with the collapse of one end of the roof all hope was given up of saving the upper stories of the building. At about 4:45 A.M. the second floor was seriously involved and shortly afterwards the famous old tower with its clock and bell collapsed. The decrease in the wind and the volume of water brought the fire gradually under control, but by this time not much was left except the walls. The building loss was estimated to be over $150,000.

The staircases collapsed early in the fire, which in the daytime would undoubtedly have meant a loss of life. Fortunately, there was no one in the build-

The disintegrating tower of the 63-year-old City Hall, which was destroyed by fire October 28, 1938.

ing at the time. The only loss of life was that of a captain of the Troy fire department who suffered a fatal heart attack while on duty at the fire.

During the height of the blaze the steeple of the First Baptist Church, which stood directly beside the City Hall, was ignited. The fire weakened the supporting beams and the top of the steeple crashed through the roof of the church, starting a fire in the interior, which was quickly extinguished. The estimated damage to the church was $25,000.

In 1929 the writer made an inspection of the care and protection given to records in this city hall. The report of that inspection stated that this building had outlived its usefulness, constituted a considerable fire hazard, and contained so much wood that in case of fire the building would probably be completely destroyed. There were nine heavy ground-supported masonry vaults with old-fashioned iron doors and equipped with wooden shelving in the building. The record protection situation at that time was in direct violation of state laws.

It has been impossible to secure an accurate check of what records were destroyed. Happily, the vaults protected their contents, which meant that the actual current working records were mostly saved. The greatest loss was in the historical museum and old record files which were located on the top floor. The steel files in which these records were kept were a complete loss. Undoubtedly when the whole story is known, the loss of valuable and irreplaceable records will reach an astonishingly large figure.

Beside the records loss, the city of Troy was materially handicapped by the complete and partial destruction of business machines, voting machines, and other general equipment. The fate of the Troy City Hall might easily be duplicated in many cities in the State. Without doubt the records of our cities are given less adequate care and protection than any of our other political subdivisions.

Soule Cotton Mill Fire, New Bedford, Mass.

On September 28, 1938, just one week after the New England hurricane and tidal flood of September 21, fire completely destroyed the Soule Mill on the waterfront at New Bedford, Massachusetts. This large loss fire was due to the following factors: (1) the sprinklers were probably shut off too soon, (2) the two fire pumps were not started during the first critical stages, (3) the fire pumps were shut down sooner than desirable, (4) the public fire department did not make full use of the total amount of apparatus which could have been assembled and the total amount of water.

The mill was 130 ft. wide and 400 ft. long, four stories high, and of brick plank-on-timber construction. Stair and elevator openings were protected and the flooring was free from belt holes, but did not butt tightly against the walls. It was sprinklered throughout in accordance with modern standards. There was a strong primary water supply for the sprinklers from the public mains, and the secondary supply was from two 1000-g.p.m. steam pumps taking suction from the river.

Since September 21 the mill had been shut down to repair damage done by the hurricane and flood. The flood had filled the basement of the mill and reached a level of 13 inches over the first floor. During the week between the flood and the fire, men were busy drying machinery and equipment, restoring electric circuits, and preparing to get the mill back into operation. The occupancy of the mill is indicated by the accompanying diagram.

Story of the Fire.

Between 7:00 and 7:30 P.M. a group of men working on a boat in the yard of the former Fairhaven Mills across the street saw a fire in the third story of the south end of the Soule Mill. They heard six or eight sprinkler

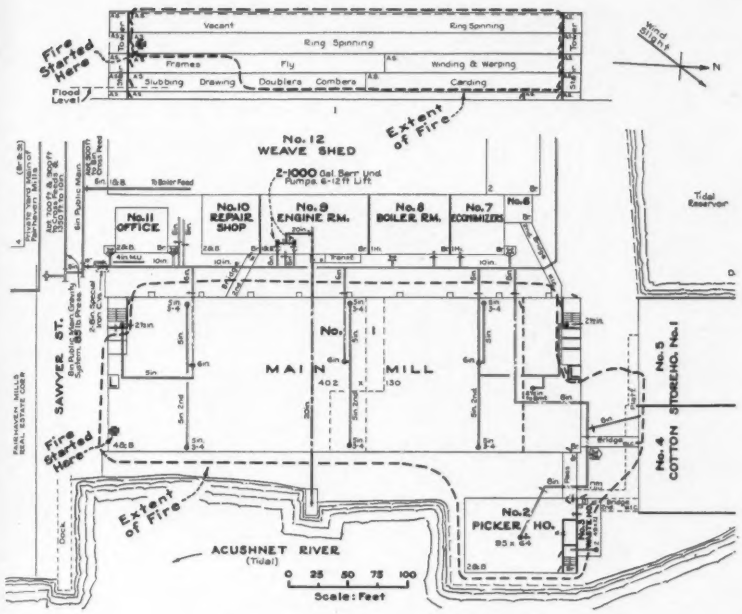


Diagram of the Soule Cotton Mill Fire.

heads go off, heard water running, and saw the fire apparently extinguished. They immediately sent word to the watchman. There is some conflict in the evidence of what occurred in the first half-hour or so, but from consideration of it and from the unusual action of the fire itself, it would appear that sprinklers opened promptly and checked the fire at the start and were then shut off, letting the fire rekindle and spread rapidly over the cotton and other burnable material. The public alarm was then sounded from the private box in the Soule Yard and recorded at 8:01 P.M., and the sprinkler valve was evidently then reopened.

With the water shut off, all of the 160 heads at the south end of the third floor would soon be opened. When the sprinkler valve was opened, there would be a flow of about 1700 gallons per minute from the public mains, but because of the many heads opened, the pressure was sufficient for only fair sprinkler service at the third-floor ceiling, and the heads that opened on the fourth floor got no water.

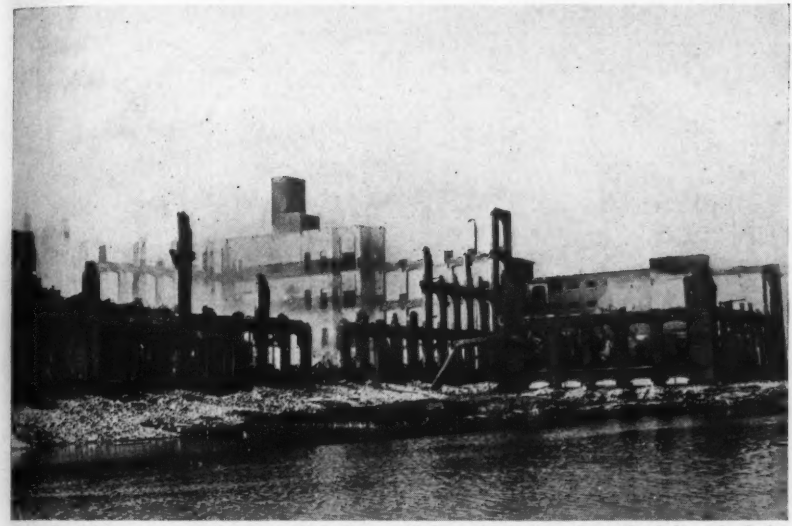
When the firemen arrived at 8:05, a serious fire was in progress. It was spreading rapidly in the third and fourth floors and was bursting out of windows in the third floor. The district chief sent in a second alarm, and tried the

Ruins of the Soule Mill, including the picker house at the extreme right. third floor, but were then shut off, after which the fire started up, spread rapidly,

sprinkler valves — finding them all open. Tests show that the public water supply at the hydrants used by the fire department was sufficient for about four pumpers working at moderate capacity. However, five pumpers were connected and apparently pulled down the pressure so that no water reached the third floor. The condition was, therefore, that of a large mill well on fire in the upper floors, with no water for the sprinklers and with only nine hose streams in service.

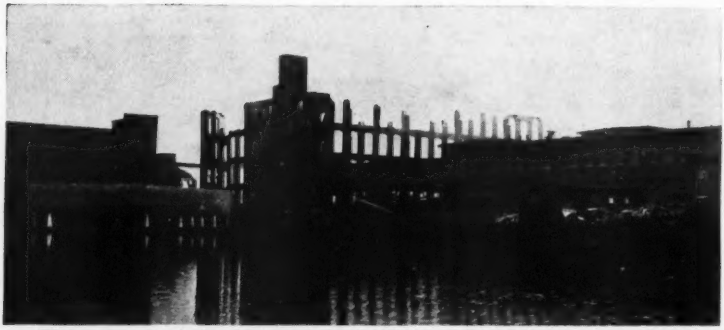
Hose streams and at least two deluge streams were operated first from the street and yard, and later from the roofs of the repair shop, engine room, and boiler room. A deluge stream was used east of the mill near Sawyer Street, but the lack of space prevented effective use and it was soon withdrawn; no other streams being used from this side. Ladders were not used against the building, nor were the ladder trucks, which are equipped to serve as water towers, used. No hose lines were taken up the southwesterly stair tower until later, when fire inside the mill at this point had been largely brought under control. Most of the fighting was from the south end and west side of the mill, and under these conditions the streams were not effective in checking the fire because of the 130 ft. width of the mill.

Three other pumpers in the city and six others in adjoining towns within a few miles were not called, apparently because it was felt that there was no available water for them from the public mains, and there was no means for



Sprinklers apparently controlled the small fire which started at the left end of the and destroyed the mill with a loss of about a million dollars.

obtaining a satisfactory suction supply from the tidal Acushnet River. In the critical first few minutes after the fire was rediscovered and the valve reopened, a strong additional water supply for the sprinklers could have been obtained from the two 1000-gallon fire pumps at the Soule Mill, but they were not started. The pumps were finally started about 8:30 P.M., but it was then too late, as the fire had already gone beyond control. About 9:00 P.M. the men operating the pumps feared the mill walls might fall and trap them in the boiler and engine rooms, so the pumps were shut down. During the half hour that these Soule Mill pumps were running, the water supply conditions were considerably better. The evidence is, however, that at no time were there more than eleven fairly effective streams being discharged into the burning mill, and practically no water after the early stages for any sprinklers on the upper floors, since the pressure at the pumper suctions was only about five pounds. If these pumps had continued operating, they could have been very helpful even after the sprinkler piping was broken, because they could have supplied eight good streams taken directly from the pumps. Two large fire pumps in the Pierce mill to the west were used to supply two hose streams through long lines of hose laid over the roofs of the intervening weave sheds. These were effective in keeping the wooden bridges between the main mill and the weave shed from burning, and helped at other points.



The rear end of the destroyed Soule Mill as viewed from across the tidal reservoir, showing the undamaged storehouses at the left and the weave shed at the right.

About 10:00 P.M. the roof of the mill started to collapse. It was soon followed by the failure of several floors, carrying fire into the lower stories. From then on efforts were mainly directed toward preventing the fire from spreading to other buildings. Shortly after midnight, in spite of falling débris, the sprinkler valves were closed, and the suction pressure at the easterly pumper increased immediately to 22 pounds. The fire was brought under control about 2:30 A.M., but streams were used intermittently on the ruins for several days.

Cause and Damage.

The cause could not be determined, but the presence of oily shavings from a bobbin-boring lathe suggests the possibility of spontaneous ignition.

Most of the mill collapsed to the level of the first floor. Weakening of the unprotected steel beams in the two upper stories by fire apparently caused the early collapse of the roof. In some sections there was evidence that floors collapsed due to burning of wooden columns, which varied from 8 to 12 inches in diameter, or to cracking of cast-iron column caps. The picker house and waste house were totally destroyed.

Conclusions.

This fire again indicates the responsibility of plant owners to see that employees are properly trained in turning in fire alarms, in the operation of sprinkler equipments, and the starting of fire pumps in case of fire. It also indicates the desirability of public fire departments being familiar with private fire protective equipment and private water supplies available at plants.

A Christmas Tragedy at Savannah.

By Charles W. Ehlers,
(Member N.F.P.A.)

It was the day before Christmas and one of the civic organizations of Savannah, Georgia, was giving a party for the orphans and underprivileged children of the city. After refreshments the happy youngsters were taken to an auditorium for a visit from Santa Claus and other entertainment. As a part of the program, a children's ballet had been arranged, the little dancers ranging from ten to twelve years.

The weather was cold and a gas heater was lighted in a small dressing room. The guard in front of the heater had long been lost or rusted away. Directly beside the heater was a table upon which were piled the lacelike ballet costumes. Shirley Jones, Jacqueline Russell and several other children stood about, already attired. A few women, among them Shirley's mother, were fitting the little dancers. Betty Baughn stood before the table; final adjustments on her costume were completed and she stepped aside to give place to another. As she did so, her skirt passed directly through the flame and, blazing freely, she dashed for the door. On the way she passed and ignited Jacqueline and Shirley. Her screams attracted the attention of the custodian of the building, who wrapped her in his coat and in doing so sustained serious burns on his hands and head. He may lose his sight. In the meantime, women in the dressing room had succeeded in wrapping and beating out the flames on Shirley and Jacqueline and the arriving firemen administered first aid until ambulances were at hand.

The scene was one of horror. While frantic firemen and volunteers worked, Santa Claus came innocently to take his part in the program. He could not understand at first why a policeman denied him admittance.

There was no fire to be extinguished. The pile of costumes on the table was not burned. The trail led from Betty's skirt and its path to the door. Betty died Christmas afternoon, Jacqueline two days later and Shirley followed her two days after that.

This tragedy shows the fatal swiftness of fire. There were at least two women in the room, one of whom was Shirley's mother. They acted promptly and did the right thing, but no human being could act fast enough to save even his own child under such conditions.

There probably have been thousands of similar fires, but few marked by greater drama and tragedy than this. It taught a badly needed lesson to many in Savannah and led to many Christmas reforms which otherwise would not have been possible, but it is a shame that such a high price had to be paid.

International.

The Cities Service Oil Co. fire, Linden, N. J., Oct. 12-13, 1938. Gasoline, kerosene and naphtha, released by the tank explosions at the start of the fire, quickly spread around the tanks. The tanks were close together, inadequately vented, were not provided with dikes (the one dike provided had not been properly maintained), and not equipped with fixed foam connections. Twenty-one tanks were involved, with loss estimated by the company at $300,000.

Cities Service Oil Co. Fire, Linden, N. J.

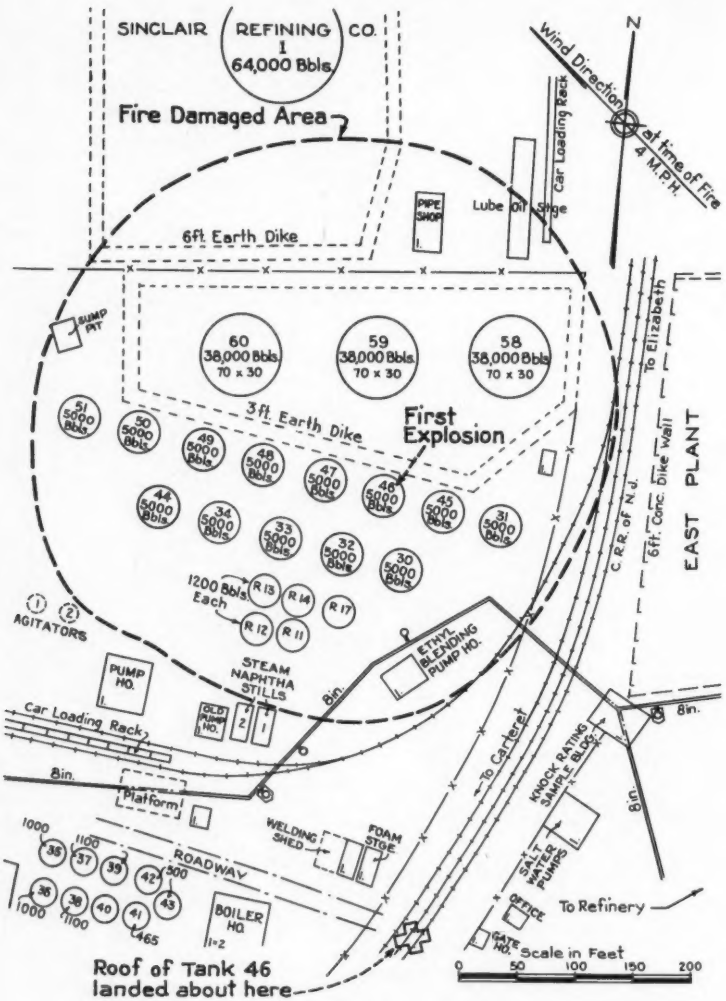
By H. E. Newell,
Secretary, N.F.P.A. Committee on Flammable Liquids.

On Wednesday, October 12, fire broke out at the plant of the Cities Service Oil Company at Linden, New Jersey. This refinery is an asphalt plant processing asphalt crudes and including gasoline, kerosene and fuel oil. It was only recently acquired from the old Warner Quinlan Company and time had not permitted the correction of some of the conditions herein described. Based upon information obtained from the company, tank No. 46 (see accompanying plan) was being pumped out when without warning an interior explosion occurred at about 12:50 P.M., which blew off the roof, depositing it on the railroad tracks more than 300 ft. away, and ruptured the tank at the bottom angle seam, thus permitting its contents to run out on the ground. This tank was of 500 barrels capacity, and contained sour gasoline, i.e., a gasoline which had not been treated for the removal of sulphureted hydrogen and other impurities. Four other explosions followed closely in tanks 58, 34, R-12 and R-14. It is generally believed that these too were interior explosions, but this is debatable. The explosions blew off the roof of tank 58, which contained crude oil, and resulted in the destruction of the roofs on tanks R-12 and R-14 shortly after. Tank 34 lost its roof several hours after the start of the fire. Although 21 tanks were involved, the area covered by the fire comprised only a relatively small portion of the plant.

Tank Construction.

Tanks were of all-steel riveted construction. Ten roofs were of the umbrella or pressure type, and eleven were of cone type. Each roof was provided with a manhole and a gauge hatch, several of which, as later indicated, were normally open.

Vents were of the gooseneck type, mainly 4 to 6 inches in diameter. Each of nine tanks was equipped with a single vent; of these six were 4 inches and three were 6 inches in diameter. Two tanks were each equipped with a 4-inch vent and a 4-inch open gauge hatch. One was equipped with one 2-inch and one 4-inch vent, and a 4-inch open gauge hatch. One was provided with four 4-inch vents and another with two 4-inch vents; one tank was equipped with a single 4-inch vent and a 4-inch open gauge hatch, and another with two 4-inch vents and one 4-inch open gauge hatch. The three largest tanks were each equipped with two 6-inch vents. So far as could be learned, some of the vents at least were provided with single screens, but they were apparently



CITIES SERVICE OIL CO.
Linden, N. J.
Diagram of Fire of Oct. 12-13, 1938.

This diagram, based on an old plan, is not accurate as to exact location and spacing of individual tanks; e.g., photographs indicate that tanks 58, 59 and 60 were only about 25 to 30 ft. apart, instead of 50 ft. as shown.

lacking on the open gauge hatches, and the futility of depending upon screens, even of 40 x 40 mesh on vent openings exceeding 4 inches in diameter, is well known.

Tank Spacing and Dikes.

The majority of the tanks were spaced in accordance with usual oil industry practices and the absence of dikes was a factor in preventing close approach by the fire fighters.

The only dike was an earth dike, i.e., that partly surrounding tanks 58, 59 and 60, the latter containing crude oil. The dike had been poorly maintained, and the southern end had been practically worn away by erosion, so that when the crude oil boiled over, it added to the intensity of the fire.

Fire Protection.

The only foam protection provided was in the form of portable foam generators. There was an ample supply of foam producing chemicals on hand for ordinary fires, but not sufficient to cope with a fire such as eventually developed. None of the tanks was equipped with fixed or permanently attached foam connections. A portable mixing column was borrowed from the Standard Oil Company, but the intensity of the fire made its use impossible.

The water mains and fire hydrants were located on the south and some distance from the area over which the fire extended; on the east, hydrants on the property of the Sinclair Oil Company were also available. This made necessary the use of long hose lines and was a further handicap to fire fighting operations. A private fire brigade made up of plant employees was provided.

Fire Fighting Operations.

The first alarm was received by telephone from the Cities Service Company at 12:53 P.M. An A.D.T. alarm was received at 12:55 P.M. and a telephone alarm from the Sinclair Oil Company at 12:56 P.M. A general alarm brought in all off-shift men, making a total of 43 men and 3 pieces of apparatus. On arrival at the fire a call for outside aid was made; this brought an engine company from Rahway and one from Elizabeth at 12:58 P.M., and later aid from Newark. Assistance was also received from the New York Fire Department in the form of a fire boat, and a 750-gallon pumper from the private fire brigade of the adjacent plant of the American Cyanamid Company.

The water mains and fire hydrants, located as they were mainly on the south side of the area involved, did not permit of the most advantageous location of the fire department pumpers. There were five in service at the fire and these were supplemented by the operation of the fire boat company, which laid 1600 feet of 3-inch hose and 500 feet of 2½-inch hose. The Rahway pumper was of 1500 gallons capacity; the others were of 750 gallons capacity.

A total of 21 hose lines was laid and located at such strategic points as fire conditions permitted. At first most of these were water lines and were used

Pictures, Inc.

The roof of tank No. 46 landed on the railroad tracks more than 300 ft. away. Railroad traffic past the plant was completely interrupted during the fire.

for cooling down tank sides in order to prevent the building up of excessive pressures, and to extinguish fires in combustible structures close to and at the edge of the involved area. However, as the result of the original explosion and those which closely followed, the liberated gasoline, naphtha and kerosene quickly spread among and around the adjacent tanks. The resulting intense fire forced off or ruptured roofs due to exposure and internal pressure. Under these conditions the use of water was of little value, and water was gradually discontinued and foam substituted. The general conditions thus created, supplemented and made worse by the absence of dikes and the great amount of radiated heat, made it impossible for the fire fighters to enter the area or make close approach to the tanks on fire, consequently fire fighting operations were necessarily conducted from the edge or rim of the fire.

At times it appeared as though the fire would spread to other areas, and this in all probability would have occurred had it not been for the coolness and skill of the fire fighters under the exceptionally able leadership of the chief and assistant chief of the Linden fire department. The fire continued through the night, but was finally brought under control and declared out at 5:30 on the morning of the 13th.

It is estimated that approximately 100 tons of foam chemicals were consumed in fighting the fire. There were employed 14 single powder type generators and two large size dual powder generators. The foam chemicals were secured from nine near-by companies storing oil and from three distributors of foam chemicals who had storages in the metropolitan area.

Pictures, Inc.

The fire was extinguished by the very large scale use of foam; 240,000 lbs. of foam powder and 40,000 gallons of foam solutions. Water was used to cool exposed tanks and buildings. Lack of dikes and close spacing of tanks interfered with close approach by the fire fighters. The available foam was exhausted about 2 p.m.; additional supplies arrived an hour later.

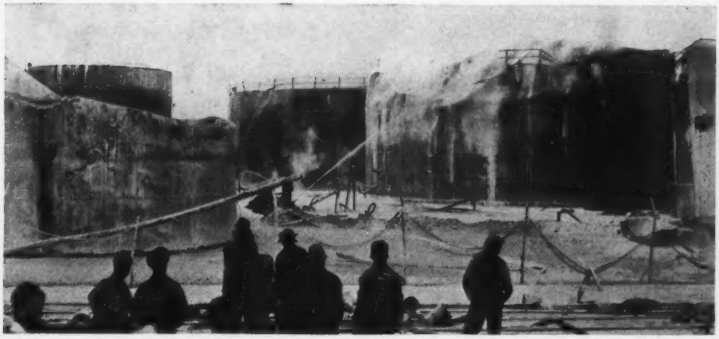
Conclusions.

In drawing conclusions on this fire it is important to remember that the tanks involved were old, of a type now practically obsolete, and lacking in those features of protection which are inherent to modern tank construction. For this reason the following statements should not be broadly interpreted to apply to oil storage plants in general, but rather to those where tanks are old and conditions otherwise equally comparable.

With these qualifications it is therefore safe to say that there are no new lessons to be learned from this fire. It was simply another graphic illustration of what has happened so frequently in the past when fire breaks out among oil storage tanks almost totally lacking in those features essential to fire prevention and protection. The work and leadership of the fire fighters was able, and effective in preventing fire spread over a greater area, but the conditions created by inadequate venting facilities, practical absence of dikes, highly flammable tank contents, including crude oil with its boil-over hazard, congestion and lack of a suitable system of foam protection, were such as to prevent close approach and restrict fire fighting to the rim of the fire area.

International.

Air view of the wreckage after the fire was out on the morning of Oct. 13. Foam (light color) covers the ground around the tanks. Note wreckage of the roof of tank 58 (upper right). This crude oil tank exploded soon after the initial explosion of tank 46. The aggregate contents of the tanks after the fire was 86,855 barrels, compared with 126,387 at the start.



Acme.

The fire was finally extinguished at 5:30 a.m. on Oct. 13. This picture, looking west from the railroad tracks, shows Tank 31 at the left and part of Tank 58 at the extreme right. The man between the tanks is standing on the inadequate earth dike.

The great amount of foam chemicals consumed directs special attention to this method of fighting oil fires. While experience has proven the value of foam for this purpose, this particular fire again demonstrated beyond question that if foam is to be effective in securing control during the early stage of a fire, it must be delivered to the seat of the fire through fixed connections attached to each tank, and supplemented by proper facilities for well-spaced foam hydrant hose streams. This and other recent oil fires prove the need of large quantities of foam chemicals where oil storages are extensive.

With reference to the cause of the fire it seems clear that the air drawn into the tank as a result of the pumping out process combined with the vapor to form a mixture favorable to ignition, and that the latter was accomplished by contact of this mixture with glowing particles of iron sulphide. It is well established that hydrogen sulphide, a constituent of so-called "sour" crudes and their products, has a corrosive effect on the metal of the tanks, the resulting iron sulphide heating to incandescence on contact with air. It frequently accumulates on the under side of the tank roof, and in this particular case an official of the company reported that an examination of the tank roof after it had been blown off disclosed accumulations on the under side.

So far as the four explosions which closely followed the original one are concerned, it is hardly reasonable to believe that the tanks involved contained explosive mixtures at the time, and that these were ignited by flame propagated through vent pipes. The most reasonable explanation is that the original explosion created a vacuum in the immediate vicinity and that the unbalancing of the normal pressures on the tank sides due to the drawing in and subsequent pushing out action caused the complete removal of or damage to the tank roofs.

Electric Light and Power Plant Fire Record.

Probably in no other industry are the results of interruption of service more serious than in case of electric light and power plants. A fire in electrical generating equipment may place a large area in darkness and completely stop or seriously inconvenience all industrial and business activity.

The electric light and power industry is growing rapidly in the United States. The total generating capacity in 1937 was double that of 1923. The total output of electrical utilities (not including the power generated and consumed in private industrial plants) in 1937 was 119,000,000,000 kwh. About 71 per cent of this electrical energy was produced in steam plants, 27 per cent in hydro-electric plants, and the other two per cent in internal combustion engine plants.

The records indicate that many of the larger and more modern electric light and power companies have taken every reasonable precaution to reduce the possibilities of interruption of service by fire in their plants. It may also be observed that new developments in plant equipment do not always bring with them decreased fire hazards.

According to a report published by the Central Traction and Lighting Bureau (Member N.F.P.A.), there have been five outstanding improvements in recent years which should reduce the fire hazard in light and power plants, and five which may not tend to reduce it. They are as follows:

Improvements Tending to Reduce Fire Hazards.

1. Installation outdoors of high tension oil switches, transformers, and other apparatus.
2. Segregation of switches and transformers into separate fire areas so they do not directly expose main generators or other important equipment.
3. Development of dependable relay protection.
4. Use of dry type lightning arresters to replace the oil-filled electrolytic type.
5. More extensive use of specially designed fire extinguishing apparatus to protect the major rotating machines and other hazardous equipment.

Improvements Which May Not Reduce Fire Hazards.

1. Generation, transmission, and distribution of higher voltages than formerly used.
2. Turbo-generator capacities greatly increased, thus exposing more valuable units to possible damage if fire occurs in the machine.
3. Pulverized coal, also oil and gas, introduced for boiler fuel with extensive storage and conveyor equipments.
4. Boilers of greatly increased capacity, operating at higher temperatures and pressures, coming into use with more elaborate auxiliary equipment.
5. Hydrogen gas employed as a cooling medium for synchronous condensers and generators, introducing a possible explosion hazard.

The following record of 271 fires in electric light and power plants occurring in the twelve-year period from 1927 to 1938 indicates the seriousness of the fire hazard and the inconvenience of interruptions due to fires. This record was compiled from reports on file in the N.F.P.A. Department of Fire Record, and while it includes only a small fraction of the total number of fires it is indicative of the general experience, especially of the more important fires. Private power plants of industrial establishments and substations are not included in this record.

From outward appearances there seems to be slight opportunity for fire to start and spread in the average fire-resistive power plant with proper subdivisions into separate fire areas, small amounts of combustible contents visible, and a full complement of fire fighting equipment. However, the presence of much oil insulated apparatus (often containing thousands of gallons of oil in a single casing) and a large quantity of combustible insulation on coils and cables constitute a considerable amount of burnable material. This record indicates how easily these materials are ignited by surges of electrical energy due to lightning or short circuits and other sources of failure or ignition.

While an occasional breakdown may be expected in spite of the various precautions that may be taken to prevent them, the typical stories of electric light and power plant fires at the end of this fire record show that many of the larger losses were due to sub-standard building construction and failure to provide adequate fire prevention or fire fighting facilities.

Causes of Fires.

Lightning is the greatest single source of trouble in electric light and power plants, and generators are the equipment most frequently involved. Failure of coils or breakdown of coil insulation due to surges or external short circuits ranks second. The fire hazard due to these and other causes would be much less serious were it not for the presence of large quantities of insulating oil used in oil switches and transformers, and lubricating oil in pressure lubricating systems for generating units. About 80 per cent, or 211 of the 271 fires, occurred at electrical equipment as listed in the following table of causes.

The separation of non-electrical causes from those involving electrical equipment is somewhat arbitrary. For example, some of the fires of non-electrical origin involved electrical equipment and some of the fires originating in electrical equipment were due in part to mechanical or other causes. Also, a fire which originated in a generator, for example, may be due to failure of other devices to protect it from lightning or surges, rather than from a fault of the generator itself.

Causes of Electric Light and Power Plant Fires.

Electrical Equipment.

Cause	No. of Fires
Generators	72
Lightning	39
Breakdown of coil insulation	19
Surges or external short circuits	6
Excessive load or disturbance	3
Faulty operation	1
Arc while removing one generator from service	1
Explosion cut oil feed line, oil ignited	1
Generator being built, probably lacquer ignited by lamp	1
Insulation breakdown between collector ring and support	1
Oil switches and circuit breakers	38
Lightning	15
Surges or external short circuits	11
Failed to operate	7
Failure of insulator bushings	2
Explosion of oil vapor in mechanism box	1
Employee opened wrong switch, causing arc	1
Employee removed oil tank by mistake, causing short circuit	1
Transformers	29
Lightning	6
Breakdown of coils	6
Surges or external short circuits	3
Internal short circuits due to heavy loads or overheated coils	3
Leaking of cooling water	2
Bushings at top failed, causing explosion	2
Arc on automatic tap-changing equipment	1
Explosions or short circuits, causes unknown	3
Unknown	3
Potential transformers; short circuits, insulation failures	6
Constant current transformers; arc, short circuit, ground	3
Instrument transformers failed	2
Motors	6
Short circuits or burnouts	3
Breakdown of field coil insulation	2
Defective collector rings of crane motor	1
Rotary converters	5
Breakdown of rotor insulation	4
Short circuit due to grounding of bolt which supported coils	1
Motor-Generator sets	3
Motor armature burned out due to error in starting	1
Lightning burned out coils	1
Short circuit in armature	1
Regulators	3
Surges caused short circuit or rupture	2
Breakdown of stator winding, burned hole in casing	1
Synchronous condensers; surge, short circuit	2
Exciters; insulation failure, failure of field breaker	2
Lightning arresters	5
Breakdown of electrolytic type, ignition of oil	4
Surge exceeded capacity of oxide film type	1
Switchboards; employee caused short circuit, lightning	3
Short in switch ignited table in test room	1

Electrical Equipment, continued.

Cause		No. of Fires
Arc ignited oil vapor in fan starting apparatus		1
Motor controller left in starting position, motor not running		1
Electric wiring		21
Failure of insulation on conductors	4	
Short circuit in generator terminal box or leads	3	
Short circuit in underground cables	3	
Short circuits in overhead wires outside plant	2	
Short circuits, miscellaneous causes	4	
Miscellaneous electrical causes	5	
Lightning (not otherwise classified above)	8	
Total fires starting at electrical equipment		211

Non-Electrical Causes.

Spontaneous ignition		8
Coal in bin	2	
Oil soaked covering on steam pipe or valve	2	
Powdered coal at base of pulverizer	1	
In filter protecting transformers from coal dust	1	
Coal in yard under trestle	1	
Coal dust and oil in coal hoist tower	1	
Coal-fired boilers		4
Congestion of coal dust in preheating air chamber	1	
Explosion of vapors accumulated in boiler uptake header	1	
Failure of coal feed screw	1	
Hot slag fell through crack to air ducts	1	
Oil-fired boilers		3
Improper care in relighting, explosion of oil vapors	1	
Oil leaked out and ignited while changing from gas to oil operation	1	
Explosion after burner went out	1	
Diesel engines		3
Fuel oil tank overflowed	2	
Exhaust muffler burned out, ignited roof	1	
Turbine being tested, vibration broke oil pipe, oil ignited		1
Steam fitting failed, live coals blown from firebox		1
Heat from steam pipe started fire in chip bin		1
Oil leaked from damper control relay to steam drum		1
Oil from lubricating oil line contacted steam line		1
Gasket failed, oil escaped into high temperature turbine		1
Overflowed oil at meter testing tank ignited		1
Oil filter paper in oven to dry ignited		1
Total fires from non-electrical causes		26

Common Causes.

Welding and cutting; sparks during repair operations	8
Storeroom fires, causes unknown	4
Smoking	3
Miscellaneous common causes	7
Exposure	5
Unknown	7
Total fires from common causes	34
Total fires covered in this record	271

While safety devices to protect the concentrated values in generating machines and other electrical equipment against fire are probably becoming increasingly dependable, no positive means of safeguarding them from lightning seems to have been discovered.

The records indicate that fires in generators are likely to spread rapidly, due to combustible insulation and air velocity. Reports of 20 of the fires originating in generators show that the number of coils involved ranges from one to 168, with an average of 20 coils involved per breakdown or fire. The extensive losses in three of the five fires included in this record which involved losses of $200,000 or more each were largely the result of the burning of large amounts of lubricating oil escaping from the forced lubricating systems used for turbo-generators.

Rupture of oil switch tanks and transformer casings resulting from the causes listed in the table is a very serious hazard because in most ruptures the burning insulating oil is scattered over other equipment, unless special provisions had been made to limit the spread. In about half of the fires involving oil switches and circuit breakers, the tanks were ruptured and oil was ignited and discharged. Some of the larger transformers contain as much as 35,000 gallons of oil, and when any such amount is released and ignited, it is obvious that serious damage may be done. The effects of proper construction features and adequate fire fighting equipment in reducing such losses are illustrated in the examples of typical fires.

The table shows that about 10 per cent of the fires were caused by the more or less common electrical wiring hazards. Other common fire hazards were responsible for an additional 10 per cent.

Construction and Type of Plants.

Complete construction data were not available from the reports of many of the fires involving electric light and power plants, but it appears that the industry as a whole is committed to the use of fire-resistive structures with properly subdivided fire areas. Several of the small plants, however, were of combustible construction and were completely destroyed by fire. Several serious losses occurred to roof structures of wood on unprotected steel supports in otherwise fire-resistive buildings. The construction of the plants was reported as follows:

Construction	No. of Fires	Per Cent of Known Construction
Fire-resistive	82	50
Semi-fire-resistive	16	10
Part fire-resistive and part frame	15	9
Brick	36	22
Frame	15	9
Total known construction	164	100
No data	107	
Total fires	271	

Most of the fires occurred at steam operated plants. Eighty-two, or about 30 per cent, occurred at hydro-electric plants, and six fires were at diesel plants. About 17 per cent of the plants included in this record supplied other services, such as gas, heat, and water, in addition to electric light and power.

Fire Loss Data.

Property loss figures were given in the reports for 197 of the 271 fires in power plants. The total loss in these fires was $2,506,000, or an average loss per fire of about $12,700. (These figures do not include the one to two million dollar loss in Belgium. See story below under date of September 28, 1932.) In seven fires a total of ten persons lost their lives; and in seven fires, 42 persons were severely injured. The following table shows the fires classified according to size of loss.

Loss	No. of Fires	Per Cent
$50 or less	10	5.1
$51 to $500	44	22.3
$501 to $1000	29	14.7
$1001 to $5000	60	30.4
$5001 to $10,000	20	10.3
$10,001 to $25,000	19	9.6
Over $25,000	15	7.6
Total fires (where data available)	197	100.0

The comparatively large loss per fire in power plants is indicative of the large values concentrated in large electrical equipment. These figures do not include loss of revenue due to interruption of service to customers which may in some instances be many more times the actual property loss. Interruptions ranging from eight minutes to several days were reported in 14 fires.

It is interesting to note, but not of great practical significance, that over half of the fires occurred in the 9-hour period from noon to 9:00 p.m., as indicated below.

Time Fire Started	No. of Fires	Per Cent
Noon to 9:00 p.m.	85	51
9:00 p.m. to 3:00 a.m.	23	14
3:00 a.m. to noon	59	35
Total fires (where data available)	167	100

Methods of Extinguishing Fires.

Automatic sprinklers were installed in 18 of the plants, but in 12 of these the sprinklers were not a factor either because the fire was localized or there were no sprinklers in areas where the fires occurred. Sprinklers satisfactorily controlled the remaining six fires in which they were a factor; completely extinguishing four, and holding in check the other two. All six of these fires were in hazardous locations; two occurring in testing laboratories, two in storerooms, one in a coal bin, and the other in an oil house. The largest loss

of the six fires was about $1750, and occurred in high-voltage testing equipment in a laboratory. This fire was due to failure of a circuit breaker to open when a breakdown occurred in a cable undergoing test. It communicated to window frames and the test bench, but two sprinklers quickly opened and controlled the fire in 15 minutes. In three of the six fires, one sprinkler head opened; in two fires two sprinklers opened; and four sprinklers opened in the other fire.

Carbon tetrachloride fire extinguishers lead the list of first aid fire appliances used to extinguish fires at electric light and power plants. The extinguishing agents used in 149 fires were as follows:

Extinguisher	No. of Fires
Carbon tetrachloride	49
Foam (including generators)	21
Carbon dioxide	6
Carbon dioxide fixed systems	2
Sand	11
Water pails	3
Blankets	2
Chemical extinguishers (type not specified)	55
Total fires (where data available)	149

In 21 fires the fire was allowed to burn itself out without the use of fire extinguishers, and in two instances no extinguishers were available. None of the reports mentioned the use of water spray systems or steam equipment for extinguishing fires in generators. Carbon dioxide fixed extinguishing systems satisfactorily controlled the two fires in generators so equipped. Hose streams from public or private hydrants or plant standpipes were used in most of the fires that extended beyond electrical equipment. The importance of an adequate water supply at power plants is indicated in the several examples of typical fires below.

In several large fires in generators and other electrical equipment it was necessary to use large quantities of water. For example, in St. Louis on January 22, 1930, arcing ignited the stator coils and rotor windings on a 2250 kva generator. The brisk and smoky fire which resulted was not affected by carbon tetrachloride and foam extinguishers. The fire, which lasted 40 minutes, was finally extinguished with one hose stream. The loss was about $7000.

Typical Fires in Light and Power Plants.

Following are typical examples of fires in electric light and power plants which illustrate the various hazards, methods of extinguishment, and losses summarized above.

Lightning Burns Out Generator Coils.

HINSDALE, N. H., AUG. 12, 1927. Lightning caused arcing at disconnecting switches on a 2300-volt bus in the basement. The heavy grounding threw open all the circuit breakers on the high voltage side, but one 2500 kva verti-

St. Paul, Minn., Jan. 3, 1928. The 32,000 KW turbo-generator in a fire-resistive generating room before the fire, which did $360,000 damage to the machine and $60,000 to the building.

cal hydro-generator flashed. The operator quickly opened the generator circuit breaker and field switch and controlled the fire with hand fire extinguishers. Ten of the armature coils at one spot and 12 at another burned out, and it was necessary to replace all of the 648 coils. The iron cores were badly burned and had to be relaid. The loss was $5000. (H-25262.)

Generator Failure Caused Rupture of Oil Line, $420,000 Loss.

ST. PAUL, MINN., JAN. 3, 1928. The generator retaining ring on the steam end of a 32,000 kw turbo-generator ruptured without any preliminary misbehavior of the unit. The meter chart showed there had been no overload, and the relay protecting the generator operated immediately. Both the high pressure lubricating oil pipe and the six-inch return pipe ruptured. Escaping oil ignited and flames shot up to the roof and continued to burn with great intensity until the flow of oil was stopped. The oil system supplying this unit contained from 2500 to 3000 gallons of oil. The intense heat severely damaged the bare steel roof trusses and wired glass windows in the roof monitor. The frame construction (to provide against condensation) over the monitor ignited and fell into the station, which necessitated shutting down the other turbine in the plant for about a half hour. The station was thoroughly modern and fire-resistive in other respects, and there was practically nothing to burn in the generator room with the exception of the lubricating system.

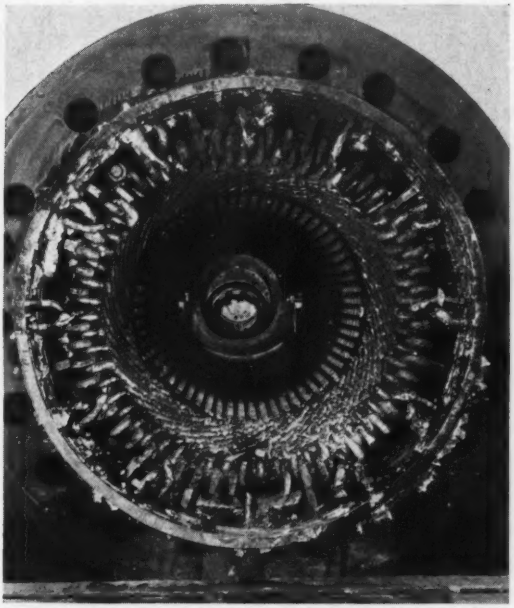
St. Paul, Minn., Jan. 3, 1928. The steam end of the same generating unit after the fire. Lubricating oil under pressure was the only fuel for the fire. Note the smoke blackened walls.

The one turbo-generator unit was damaged beyond repair; the loss to the machine was estimated at $360,000, and to the building $60,000. Employees did excellent work in bringing the fire under control before the arrival of the fire department by using the fifty-four 1-quart and six 1-gallon carbon tetrachloride extinguishers, and eleven 2½-gallon soda-acid extinguishers with which the plant was equipped. (See April, 1929, QUARTERLY, page 416. H-25523.)

Stator Coils Destroyed Due to Difficulty in Extinguishing Fire.

DAYTON, OHIO, APRIL 10, 1928. About 7:00 A.M. a short circuit occurred in a 25,000 kva turbo-generator that had carried the entire load through the night. In anticipation of the usual morning demand, two other generators had already been thrown in. These generators were cooled by ventilating air drawn from outdoors and again discharged outdoors. They were equipped with differential relays arranged to trip the main oil switch and the field switch in case of internal short circuit or ground. The generator that shorted and one other were equipped with 1¼-inch perforated copper pipes around the inside of each end over the windings, but the pipes had not been connected to a water supply for fear of possible water damage to the windings.

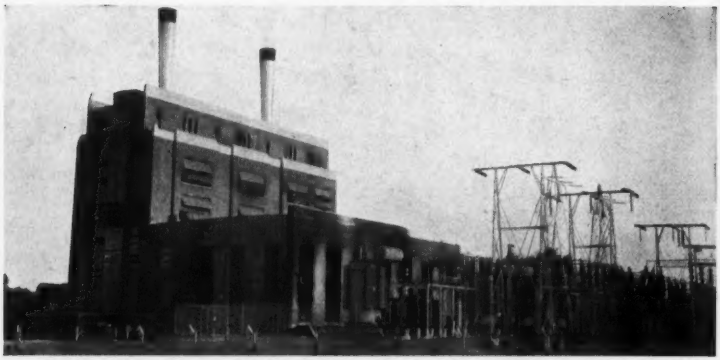
When the short circuit occurred, the differential relays opened the field switch and disconnected the machine from the busses. The operator immediately shut off the steam from the turbine, but the machine continued to run by momentum for a half hour. Meanwhile, smoke issuing from the casing



Dayton, Ohio, April 10, 1928. About $45,000 damage was done to this 25,000 KVA generator when fire started from a short circuit near the bottom of the stator coils.

showed fire to be in the end farthest from the turbine. Station men uncovered the portholes in the upper part of the casing and discharged twenty-eight 1-gallon carbon tetrachloride extinguishers into the machine. The liquid could not reach the fire in the power part. The rotation fanned the fire and created air currents which carried the gases out through the ventilating ducts, thus preventing a blanketing and extinguishing action. Smoke driven out through the portholes filled the station and made fire fighting difficult.

The chief engineer then instructed that water be used. This had not been done previously for fear of water damage to the coils. After some delay in removing the bolts, attaching the crane, and lifting away the heavy casing, a large hose stream was used and the fire extinguished in a few minutes, about a half hour after it first broke out. Examination later showed that the short circuit had occurred in the lower part of the machine, due probably to a breakdown of insulation between a stator-coil collector ring and a grounded support. The insulation on the end of the stator coils ignited, and the fire fanned by the rotor quickly swept around the end of the machine. Because it could not be promptly extinguished, the stator coils were destroyed, the rotor was damaged so as to need rewinding, and the steel frame was cracked. The loss was estimated at $45,000. (S-47632.)



Bremo Bluff, Va., June 28, 1932. Damage of about $200,000 was done to this power plant when leaking oil was ignited by a high pressure steam pipe.

Large City Without Light and Power for Nearly One Hour.

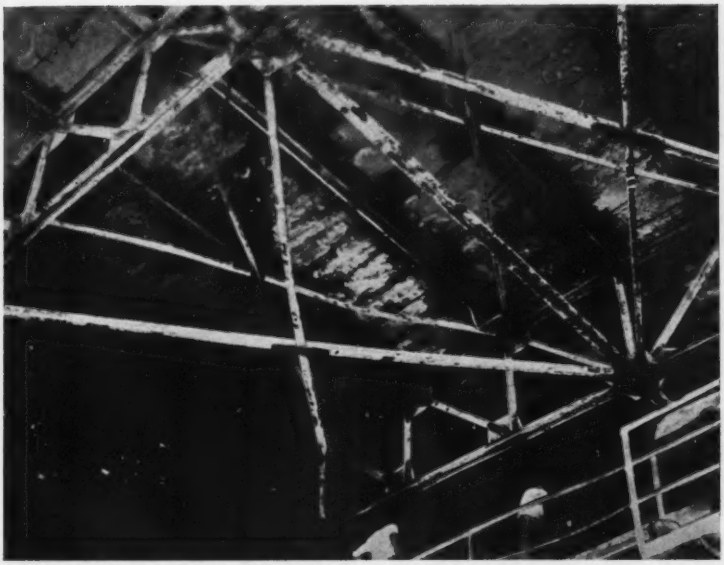
NEW ORLEANS, LA., AUG. 28, 1931. Lightning caused burnouts in four 15,000-volt oil circuit breakers. The arcing seriously damaged the concrete switch cells, two current transformers, and several switch control motors. The fire was extinguished with carbon tetrachloride and foam type extinguishers. The damage was estimated at $25,000. The entire city and surrounding territory was without electricity for 56 minutes. (H-32898.)

Twelve Regulators Explode and Throw Burning Oil.

LEXINGTON, KY., JUNE 15, 1932. A surge of current caused by lightning getting by arresters ruptured a regulator containing about 45 gallons of oil. In about 40 seconds the regulator exploded, spreading burning oil over other regulators and also the switchboard five feet away. Eleven other regulators quickly exploded, throwing burning oil and destroying the switching apparatus which controlled all generators and lines between this generating station and three others in the community. The loss of $49,000 was confined to this apparatus. (H-35586.)

Leak in Oil Line, $200,000 Damage in Fire-Resistive Plant.

BREMO BLUFF, VA., JUNE 28, 1932. Fire occurred in a new power plant of fire-resistive construction with gypsum block roof on unprotected steel frame, and containing two 18,750 kva, 13,750-volt turbo-generators. Only one generator was in operation when employees noticed a leak in a half-inch oil pipe between a 750-gallon oil reservoir and the turbine. The oil leakage was caught in buckets and emptied back into the reservoir, the cover having been removed for this purpose. Efforts were being made to switch the load from this generator to the other unit when the oil line broke completely at the point of the leak and spraying oil came in contact with an uninsulated part of the high pressure steam line to the turbine. The oil ignited and fire spread to the oil in the reservoir. The generator was shut down, but oil continued to flow from the pipe due to the automatic operation of the auxiliary oil pump on the lubricating system. Oil leaked through the metal flooring to equipment below and burned with great intensity. All available hand extinguishers were

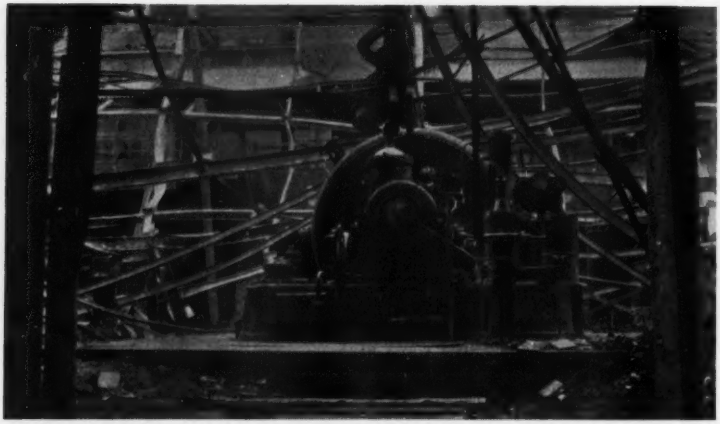


Bremo Bluff, Va., June 28, 1932. The roof of the generator room after the fire shows evidence of intense heat. Several of the unprotected steel roof trusses were badly warped.

emptied on the fire with little or no effect, and the fire was left to burn itself out. After burning about an hour a dull explosion in the generator room blew out all the windows in the generator room and a few in the boiler room. The carbon dioxide system protecting the generators was manually tripped to protect the insulation from damage by heat. The fire burned itself out after a duration of one hour and forty minutes. One high pressure turbine was seriously damaged, but the other unit was put back into service within two hours. Some of the roof trusses were badly warped and the entire building was smoke damaged. The traveling crane was badly damaged. About 650 gallons of oil were destroyed. The loss was about $200,000. (See October, 1932, QUARTERLY, page 151. H-35779.)

Largest Power Plant Loss on Record.

BRUSSELS, BELGIUM, SEPT. 28, 1932. Damage between one and two million dollars resulted at the municipal power plant when fire started from a short circuit in electric wiring to a motor driving an auxiliary oil pump for a small turbo-generator of the old type. Fire evidently spread over oil covered surfaces in the vicinity of the steam turbine, reaching a pail which was in use to collect dripping oil from a defective oil governor. Heat from the burning oil apparently increased the defect of the governor, permitting oil under high pressure to be forced out and ignited. The wood roof, supported on exposed steel trusses, collapsed. (H-36198.)



Brussels, Belgium, Sept. 28, 1932. Oil and a wooden roof contributed to the loss of over a million dollars at this power plant.

Kite String Short Circuits Power Line.

GREENSBORO, N. C., MAR. 1, 1933. The tinsel string on a kite fell across a 3-phase 13,000-volt line, causing an oil circuit breaker in the power plant to open. The heat and pressure developed in the circuit breaker threw oil out of the circuit breaker and caused it to ignite. Employees extinguished the fire with extinguishers, sand, and one hose line. About $1000 damage was done to circuit breaker bushings, current transformers, adjacent insulators and busses, and two windows. The child flying the kite was not injured because the tinsel did not extend all the way to the ground. (H-36577.)

Burning Oil Does Serious Damage in Switch House.

BOSTON, MASS., APRIL 15, 1933. A short circuit occurred in the primary winding of a 200-watt oil-cooled potential transformer on the first floor of a switch house adjoining the generator room. The apparatus in this room is located in reinforced concrete cells with wood frame doors. When the trouble occurred the 13,800-volt oil switches in the room above opened properly and isolated the circuit. The casing of the potential transformer ruptured and the burning oil (capacity of tank four gallons) ignited the doors of the cell, and flowing from the cell, which had no sill, ignited other cell doors. Heat operated the fire door at the entrance, and smoke blackened much of the cell structure. Employees extinguished the fire with carbon tetrachloride extinguishers. Eight cell doors were destroyed and 17 damaged. One potential transformer was destroyed and one damaged. Three current transformers were damaged. The loss was about $2,300. (H-36992.)

Surge Causes Fire in Lightning Arrester.

FLORIDA, MASS., APRIL 26, 1933. Fire occurred in a 11,000-volt electrolytic lightning arrester located in the oil switch and transformer room (not enclosed or cut off) of a fire-resistive hydro-electric power station. Apparently a surge entered from the outside and blew off the top of the arrester case, de-

stroying 12 cones. A 66,000-volt bushing of a line just overhead was damaged and the wall was damaged from the burning electrolyte. The damage was estimated at $140. This arrester was replaced by an oxide film type located outside. (H-37669.)

Lightning Arrester Fails to Stop Surge, Generator Damaged.

BRADFORD, PA., JUNE 25, 1933. Lightning struck a 33,000-volt transmission line and the surge to the outdoor switches and transformers arced across to the 2300-volt side and entered the fire-resistive power plant. The lightning arresters at the outdoor structure had no effect and the switches did not open automatically. The disturbance was noted by the operator at another station and he cut the power off the line. One transformer had to be shipped away for repairs, and some damage was done to insulators and other equipment outside and behind the switchboard. Reserve gas engine driven generators were rushed into operation and service was resumed one hour and twenty minutes after the trouble started. The loss was about $8500. (H-37181.)

Oil Leaking from Test Equipment Ignited by Boilers.

PROVIDENCE, R. I., JULY 21, 1933. Oil fuel used at this plant is fed through meters for accurate checking of power produced from a known quantity of oil burned. For testing the meters, a 500-gallon tank and equipment were located on a deck floor under the roof of an old boiler section. While making a test, oil pressure in the drain pipe from the test tank ruptured the valve in the drain. Oil ran down building columns, through floor gratings, and to boiler firing doors on the main floor, where it ignited. The burning oil damaged the building to the extent of about $10,300. (H-38393F.)

Stator Coil Breakdown, Oil Switch Failed.

DEFERIET, N. Y., SEPT. 17, 1933. The insulation on stator coil windings of a hydro-generator broke down. The resulting excess current passed to ground, placing an unbalanced phase condition on the differential relays. The relays operated and placed a current on the oil switch tripping coil, but for some unknown reason the mechanism of the switch failed to disconnect the generator. The fire was extinguished with foam, carbon-tetrachloride, and soda-acid extinguishers. The field was not damaged, but 95 stator coils were burned and about one-fourth of the stator iron laminations were burned by arcing. The coils not damaged could not be removed without damaging their insulation, therefore, the entire 428 stator coils had to be replaced. The loss was about $3900. (H-37189.)

Delay in Cutting Off Transformer Involved in Oil Fire.

NEW YORK CITY, N. Y., OCT. 31, 1933. Failure of insulation, possibly due to moisture, occurred in a 28,000-volt pothead of a transformer adjoining a steam electric generating station. The resulting short circuit broke the metal body of the pothead. A flying piece of metal made a small hole in a tube of one of the transformer radiators near the top, but at a point about three feet below the oil level in the conservator tank. Oil flowed out and was ignited by the arc or by hot metal resulting from the arc. Extinguishment could not be attempted until all transformers were cut off. This took about fifteen minutes, owing to the inter-connection between companies at various substations. The fire was then extinguished in about half an hour by using a foam generator and

hose streams. Two transformers, disconnecting switches, insulators, and cables were damaged to the extent of about $8000. (H-37646.)

Explosion While Relighting Manually Operated Oil Burner.

PORT ARTHUR, TEXAS, Nov. 2, 1933. The boiler operator discovered that one of the oil burners was out and was preparing his torch to relight the burner when a flash occurred. He had opened the damper and some combustible material or soot in the furnace was fanned into flame by increased draft, igniting explosive fuel oil vapors in the furnace and breeching. No general fire ensued, but the explosion and burst of flame damaged the building as well as the boilers and breeching. The loss was about $4000. (H-39609.)

Spontaneous Ignition of Coal, Delay in Effective Use of Water.

ROCKWOOD, PA., JULY 7, 1934. This was a reserve turbo-generator plant of largely frame construction. It had not been operated during the past month. The fire was believed to have been caused by spontaneous ignition of bituminous coal which had been placed in a frame bin over the coal crusher about ten days before. The attendant blew the plant whistle. Other employees responded and obtained one hose stream from the private hydrant on a 4-inch connection from the public main, but the pressure was not satisfactory. The local fire department provided four streams by pumpers drafting from the river. Nearly three hours were required to extinguish the fire because it had gained considerable headway before it was effectively attacked by hose streams. The joisted roofs of the boiler house and generator house were destroyed and the frame portions of both buildings were either destroyed or badly charred. The coal bins, coal trestle, and conveyor belt were heavily damaged. The loss was heavy, but estimated to be under $250,000. (H-39776.)

Plant Destroyed, City Without Electricity Six Days.

SUTTON, NEB., DEC. 3, 1935. Fire originating from an unknown cause in a storeroom of the municipal light plant completely destroyed the two reciprocating steam engines and generators, the new switchboard, and the city's fire truck and road machinery which were housed in the building. The city council was in session in an adjoining room when the fire was discovered at 10:00 P.M. by the night engineer. Five fire departments responded to calls, but by the time they arrived the fire was spreading so rapidly through the stone and frame stucco building that they were too late to save it. The loss was $100,000. The city was without electricity for six days until a connection could be made to the power system of a near-by city. Fortunately the standpipe was full of water at the time and a tractor could be connected to the pump to prevent interruption of the water supply. (H-40934.)

Circuit Breaker Failure, Cities in Darkness.

NEWARK, N. J., DEC. 28, 1936. Failure of a 13,000-volt oil circuit breaker on the fifth floor of a generating plant caused a fire at 4:12 P.M. which left most of the city of Newark and communities in three counties without electric service for five and one-half hours. Fumes from the burning oil penetrated to the floor above and deposited a heavy coating of soot or carbon on the insulators, causing short circuits. The fire was extinguished in less than a minute with a water spray nozzle. (H-41539.)

Transformer Short Circuit, 600 Gallons Oil Ignited.

FORT WAYNE, IND., JULY 6, 1937. The fall of a high tension power line in a city street short circuited a transformer at the power plant and set fire to the 600 gallons of oil in the transformer. To protect firemen and safeguard other equipment the turbines were stopped. This was the first complete shutdown of the plant in 14 years. Firemen and employees soon had the fire under control, but the loss totaled about $25,000. (H-42076.)

Coal Wharf Fire Threatens Power House.

LYNN, MASS., FEB. 10, 1938. Fire starting from an unknown cause under the creosoted wooden deck of a coal unloading wharf of a large gas and electric company, seriously damaged the wharf and destroyed two coal unloading towers. Attempts to use hose streams and cellar nozzles under the deck were ineffective. Fire destroyed the rubber conveyor belt in the enclosure leading to the power house, but was prevented from entering the power house by employees using a small hose stream supplied by a standpipe in the top story of the power house. Coal was handled temporarily by trucks and portable cranes, and there was no interruption of service. The loss was nearly $500,000. (See April, 1938, QUARTERLY, page 319. H-42775.)

Lineman Causes Ground, Generator Windings Destroyed.

WEST BUXTON, MAINE, MAY 11, 1938. While a lineman was making new connections to a local distribution line on a pole near this fire-resistive hydro-electric plant, his steel wrench came in contact with the grounded casing of an oil switch. The switch relay in the plant apparently did not function, as the controlling switch failed to open, and thus a short circuit occurred. A series of terrific explosions at two generators caused dense clouds of smoke which forced the operators outside before they could open switches or clear the fault. The operator ran out and shut the station down by shutting the gates at the dam. When it was possible to get inside, the fire was extinguished with three 40-gallon foam extinguishers and several carbon tetrachloride extinguishers. All stator windings of the two generators were destroyed, but there was no damage to the building other than by smoke. The loss was about $25,000. (H-42773.)

Oil Overflowed in Diesel Plant, Improper Arrangements.

DESHLER, OHIO, JULY 30, 1938. The man on duty at the diesel-operated municipal power plant apparently forgot to shut off the fuel pump and allowed oil to overflow. Below two 250-gallon auxiliary tanks supplying the diesel engines was a channel in the concrete floor in which were the exhaust pipes to the outside. This channel was covered with steel plates, but oil seeped into it and vaporized in the enclosure. At about 7:15 P.M., the heavy load came on and the engines were working at increased speed, thereby heating the exhaust pipes more than normal. This temperature undoubtedly ignited the vaporized oil and caused a severe flash fire. The man on duty immediately turned in a fire alarm and the fire department arrived in about five minutes. By this time the entire roof structure was ablaze. All power was cut off and hose streams were used. In about thirty minutes the fire was under control and confined to the main section housing the engines and generators. This building was of brick construction with wood-joisted roof on steel girders. The damage, estimated at $20,000 was largely to the roof structure and electrical equipment. (H-42774.)

Fires in Which There Was Loss of Life.

Last Quarter, 1938.

Since the publication of the October, 1938, QUARTERLY, the N.F.P.A. Department of Fire Record has received reports of 162 fires in which there was loss of life. Three hundred and eleven persons lost their lives as a result of these fires. During this period, the following fires were reported in the United States and Canada, which caused the loss of more than five lives each.

SEPTEMBER 11, 1938, RIMOUSKI, QUEBEC. Six men were killed and seven other persons were injured in a fire which destroyed the Hôtel des Vagues at Rimouski Wharf. Four of the victims were members of one family. The fire, of unknown origin, occurred early in the morning when nearly everyone was asleep. (H-42752.)

OCTOBER 8, 1938, AMERICUS, GA. Seven negro children were burned to death when fire of unknown origin destroyed their home near this city. Another child was seriously burned. (L-5195.)

OCTOBER 11, 1938, FORT FRANCES, QUE. At least 20 persons lost their lives in a forest fire which raged along the Minnesota-Ontario boundary for several days and two others died as an indirect result of the fire. An elderly man succumbed to a heart attack while fighting the fire and a youth was killed in an automobile accident while rushing to assist in extinguishing the blaze. (H-42753.)

OCTOBER 12, 1938, DEEP RIVER, CONN. Flames took the lives of five trapped children and fatally burned their father who tried to rescue them after the kitchen stove exploded while he was starting a fire. Exactly what happened is not known. Firemen said they understood that he was kindling a fire by pouring on a flammable liquid, but one of the surviving children said it was a gasoline operated stove. The village fire department was delayed in reaching the scene because the local fire alarm system had been out of order for three weeks following a hurricane. (L-5196.)

NOVEMBER 12, 1938, ROUYN, QUE. Seven persons lost their lives in a fire which destroyed Albert's Hotel. The fire started in a room at the rear of the second floor from an unknown cause, and spread with such rapidity that the victims were trapped. (H-42772.)

Foreign Fires.

Several fires involving large losses of life have been reported during this quarter from outside the United States and Canada. These fires are not included in the tables, but summaries of the most important are given below.

SEPTEMBER 8, 1938, GERONA, SPAIN. The report of this fire, which reached us too late for inclusion in the October, 1938, QUARTERLY, states that at least seventeen persons were known to have died in a fire which burned the wooden coaches of a railroad train on the outskirts of this city, after a collision with a gasoline-laden tank truck, which exploded. (H-42757.)

OCTOBER 7, 1938, YUBARI, HOKAIDO, JAPAN. A coal mine blast was reported to have taken 151 lives. (H-42758.)

OCTOBER 10, 1938, SOEST, GERMANY. Sixteen passengers, all Germans, and a Belgian crew of four were killed when a Belgian airliner crashed near here. The passengers were said to have fallen or jumped from the plane before it fell in flames. (H-42759.)

OCTOBER 29, 1938, MARSEILLES, FRANCE. A fire which started in a department store and destroyed several other buildings took the lives of seventy-five persons and injured many others. (H-42761.)

Loss of Life Fires, October-December, 1938.*

This is a typical rather than a complete record, presented to show the conditions under which loss of life occurs, that they may be known and guarded against. The total loss of life by fire in the United States is estimated at 10,000 annually.

Class of Fire	No. Fires	Men	Women	Children	Total
Airplanes	8	18	3	1	22
Amusement places	4	4	1	0	5
Apartments, rooming houses, tenements, hotels	23	26	12	8	46
Automobiles, trucks	10	12	5	1	18
Tank truck fires	10	17	0	0	17
House trailer fires	2	2	0	0	2
Barracks or bunkhouses	1	1	0	0	1
Chemical laboratories	1	1	0	0	1
Churches	1	1	0	0	1
Dwellings—rural	23	7	9	45	61
Dwellings—urban	36	12	13	18	43
Forest and brush fires	7	17	4	16	37
Garages	4	5	0	0	5
Institutions	2	6	0	0	6
Manufacturing occupancies—miscellaneous	3	5	0	0	5
Mercantile occupancies—miscellaneous	5	5	1	0	6
Mining property fires	2	7	0	0	7
Municipal buildings	2	4	0	0	4
Oil refineries	2	2	0	0	2
Out of door fires	6	1	1	4	6
Response to alarms	3	5	0	0	5
Restaurants	3	4	0	0	4
Schools	2	2	0	1	3
Ships and boats	1	0	1	0	1
Tank vessels	1	3	0	0	3
Totals	162	167	50	94	311

*This table is made up from those reports received by the Department of Fire Record between Sept. 11, 1938, and Dec. 10, 1938. A few of the fires included herein occurred prior to Sept. 11, but were not reported until subsequent to that date.

NOVEMBER 3, 1938, CARCASSONNE, FRANCE. Six persons were burned to death and an equal number seriously injured when a bus lost a wheel, overturned and caught fire after the gasoline tank exploded. (H-42763.)

NOVEMBER 4, 1938, ST. HELIER, JERSEY, CHANNEL ISLANDS. Fourteen persons, including four women and a child, were killed when a British airliner caught fire, crashed in a field and then "exploded," two minutes after taking off. The cause of the fire was not determined. (H-42762.)

NOVEMBER 20, 1938, GUAYAQUIL, ECUADOR. Eight persons were killed in a stampede which followed when a hoaxer cried "Fire!" in a crowded theatre in this city.

In addition to the above, there have been several serious conflagrations in various parts of China which have been reported as claiming the lives of well over two thousand persons and destroying millions of dollars worth of property. (H-42755; H-42756; H-42760.)

Typical Loss of Life Fires.

Airplane Fires.

OCTOBER 29, 1938, WILLIAMSON, W. VA. A prominent woman flier was burned to death when her plane crashed in flames in a cornfield. (H-42765.)

DECEMBER 5, 1938, CORONADO, CALIF. Two Navy fliers were burned to death when their scout bomber crashed into an unoccupied garage. (H-42764.)

Automobile, Truck and Tank Truck Fires.

SEPTEMBER 25, 1938, CAMDEN, N. J. One man was burned to death when a car he was driving overturned and burst into flames after a tire blew out. He was trapped in the blazing car. A companion saved himself after being thrown clear of the wreck by rolling in the grass to extinguish his flaming clothes. (L-5197.)

OCTOBER 13, 1938, SACRAMENTO, CALIF. Exploding butane gas killed two men and critically injured another when a tank truck rammed into a passenger train. Both the victims were seated outside the flagman's house at the crossing when the accident occurred. (H-42750.)

OCTOBER 31, 1938, MIDDLETOWN, OHIO. Two members of a train crew and the driver of a gasoline-laden tank truck were burned to death in a train-truck collision. (H-42754.)

Clothing Ignited.

OCTOBER 4, 1938, IRVING, TEXAS. His clothing entirely burned from his body after he touched a high-tension wire carrying 66,000 volts, a nine-year-old boy was burned to death. The boy with four of his brothers had gone to water cows; he lagged behind to climb a steel tower which supports high tension electric power lines. When his brothers missed him, they turned back, arriving at the foot of the tower to see him plunge to the ground a flaming, screaming torch. (L-5189.)

Causes of Loss of Life, October-December, 1938.

Fatalities classified according to the immediate cause of the loss of life rather than according to the cause of the fire.

Class of Fire	Men	Women	Children	Total
Airplane fires	18	3	1	22
Asphyxiation	3	0	2	5
Automobile or truck collisions and fires	12	5	1	18
Collision of automobile with tank truck	3	0	0	3
Collision of train with tank truck	14	0	0	14
Clothing ignited (other than following classifications)	2	0	1	3
Bonfires, rubbish fires	1	1	3	5
Burning gasoline	0	2	0	2
Candle	0	0	1	1
Falling into fire	2	0	0	2
Gas stove	0	3	1	4
High tension electric cable	0	0	1	1
Matches	0	0	3	3
Oil stove or oil heater	0	2	3	5
Paraffin (molten)	0	1	0	1
Smoking (see also smoking in bed)	0	1	0	1
Entering or re-entering a burning building	1	0	0	1
Escaping fires; jumped, fell or drowned	0	1	0	1
Explosions, miscellaneous	5	0	0	5
Chemicals	1	0	0	1
Dynamite	5	0	0	5
Furnace	1	0	0	1
Illuminating gas	3	4	1	8
Fire fighting—firemen	16	0	0	16
Fire fighting—private individuals	11	0	0	11
Flammable Liquids and Vapors fires				
Flammable liquid fire on a tank ship	3	0	0	3
Gasoline lanterns and stoves	0	2	3	5
Gasoline used to clean garage floor	1	0	0	1
Gasoline mistaken for water; used to extinguish fire	0	1	0	1
Gasoline fires, not otherwise classified	4	0	0	4
Kerosene used to start a fire	3	0	4	7
Oil refinery fires	1	0	0	1
Oil storage tank fires	2	0	0	2
Paint and varnish fires	0	1	0	1
Forest or brush fires (excluding fire fighters)	4	4	12	20
Mine fires and explosions	2	0	0	2
Response to alarms				
Overexertion by firemen	2	0	0	2
Thrown from apparatus	3	0	0	3
Smoking in bed	5	1	0	6
Trapped in burning building	38	18	57	113
Trapped in incendiary fires	1	0	0	1
Totals	167	50	94	311

OCTOBER 9, 1938, SEATTLE, WASH. Showered with burning paraffin when a can of wax exploded on her kitchen stove, a housewife was fatally burned.

OCTOBER 29, 1938, DES MOINES, IOWA. One woman was killed and another critically burned when the kitchen stove ignited the fumes of gasoline which they were spraying in the house to kill insects. (L-5191.)

NOVEMBER 8, 1938, CLEVELAND, OHIO. Cleaning a grease-stained floor with gasoline at an automobile service station brought death to one man and

seriously burned another. Static electricity, generated by rubbing the concrete floor with a gasoline soaked rag, is believed to have ignited the fumes, setting fire to the men's clothing. (L-5192.)

NOVEMBER 24, 1938, REDDING, CALIF. Six persons were burned, one fatally, when a bucket filled with gasoline was mistaken for water and used in an attempt to extinguish a small fire under a gasoline stove in an automobile trailer. (H-42749.)

Escaping Fires.

OCTOBER 11, 1938, GREENFIELD, MASS. A young woman was killed when, trying to leap from her blazing fourth floor apartment to the roof of an adjacent building, she missed by inches and dropped 35 feet into an alley. (H-42766.)

Explosions.

SEPTEMBER 2, 1938, HILLSIDE, N. J. A workman was killed when an acetylene torch exploded the fumes in an empty gasoline tank truck which he was repairing. (H-42747)

DECEMBER 12, 1938, STAMFORD, CONN. A chemist was killed and two other men were injured in a terrific chemical explosion in an industrial research laboratory. (H-42748.)

Falling Into Fires.

OCTOBER 28, 1938, BAKERSFIELD, CALIF. A young man was burned to death when he tripped and fell in a wheat field near this city, as he was burning off the field to clear it of stubble. (L-5198.)

Forest and Brush Fires.

OCTOBER 19, 1938, EMPORIUM, PA. Five CCC workers were burned to death while fighting a forest fire 25 miles south of this town, when a sudden shift of wind trapped them in a gully between two sectors of the blaze. (H-42767.)

Firemen.

NOVEMBER 5, 1938, NEW YORK CITY. Plunging down a dumb-waiter shaft in a tenement, a fireman was killed here when he sought to inspect the shaft for embers directly following a fire. (H-42770.)

Smoking in Bed.

NOVEMBER 18, 1938, NEW YORK CITY. Smoking in bed brought death by suffocation to a hotel resident. A police emergency squad worked for over an hour on the man without success. (H-42751.)

Trapped in Burning Buildings.

SEPTEMBER 26, 1938, GRAND RAPIDS, MICH. Four children were burned to death when trapped in their beds by a fire which destroyed their farm home near this city. (L-5200.)

OCTOBER 22, 1938, BROOKLYN, N. Y. A man was fatally burned when he was trapped on the top floor of a flaming tenement. (L-5202.)

VISIONS